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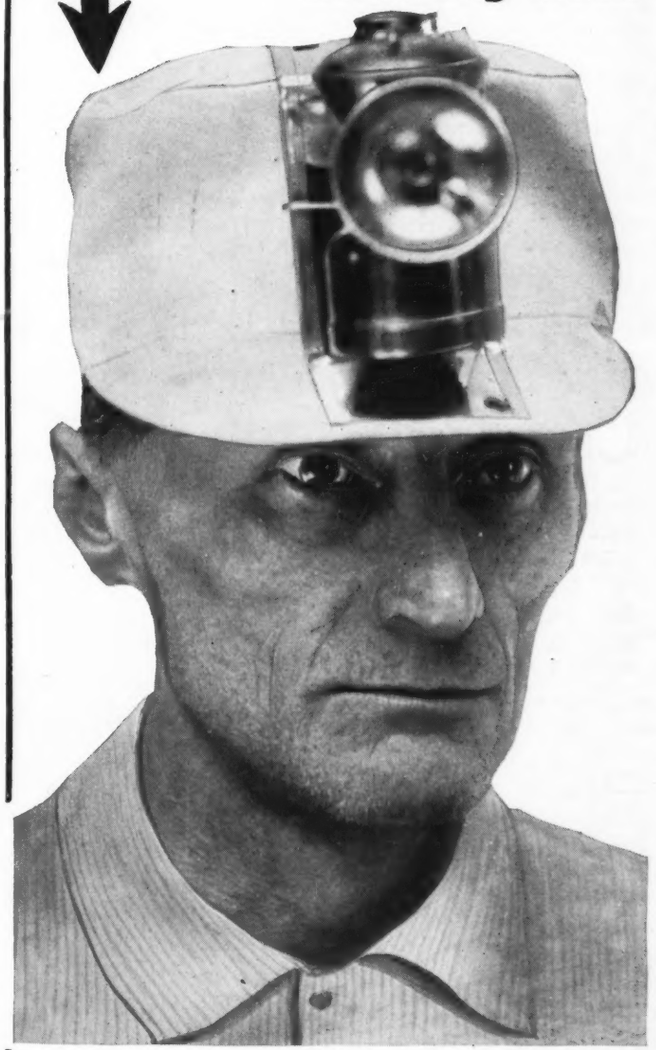
Breathing Rock Dust Did It



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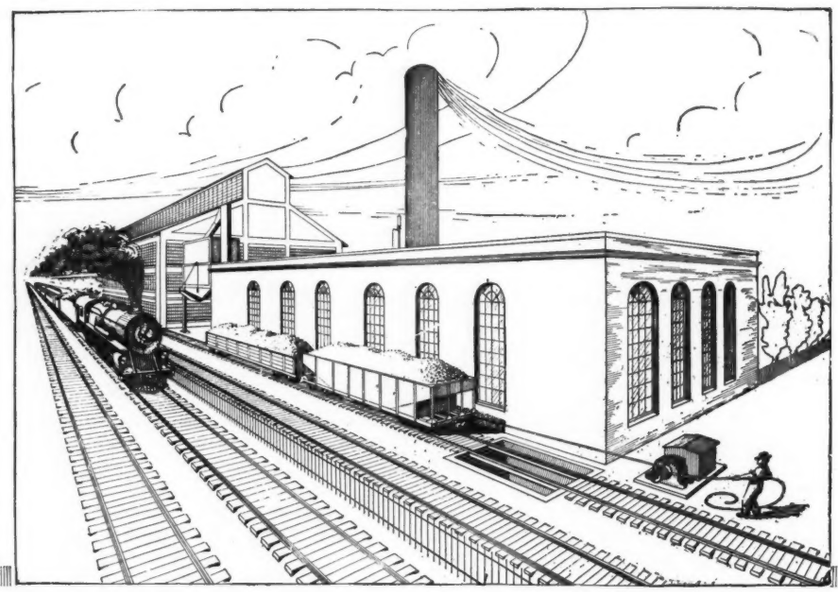

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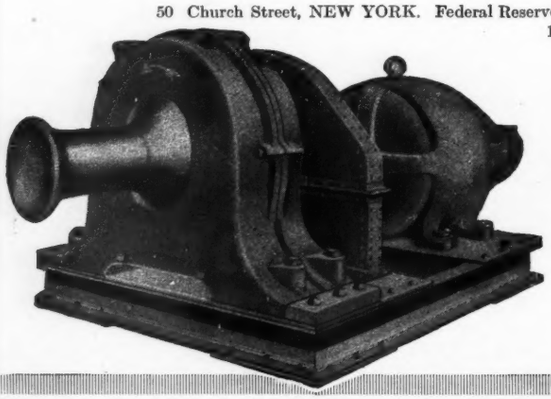
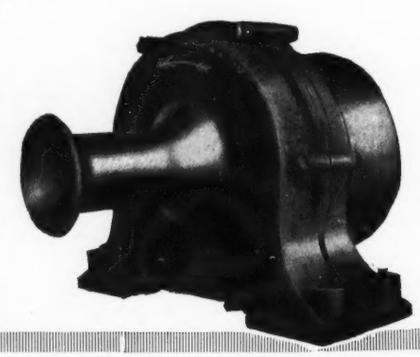




Mining Journal

VOLUME 101 JANUARY 22, 1916 NUMBER 4

A California Dredge with Two Tailings Stackers

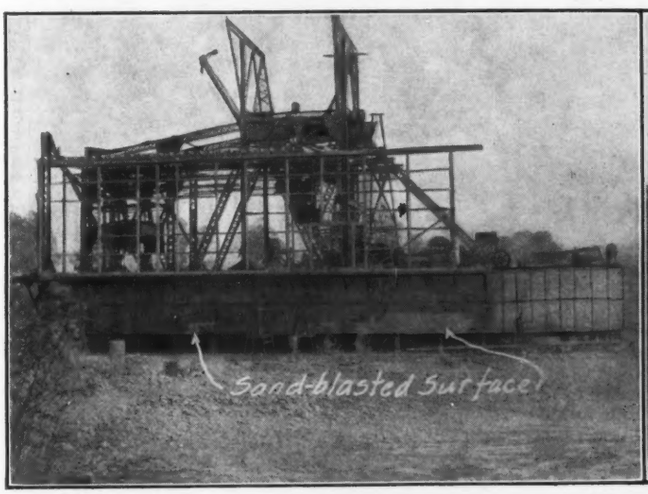
By Lewis H. Eddy*

SYNOPSIS—New method of reclaiming dredged ground for agricultural use, coincident with gold recovery. Two tailings stackers are used and two double-deck tail sluices. The practice is exemplified by Natoma No. 4 dredge of the Natomas Co., operating in the American River district of California.

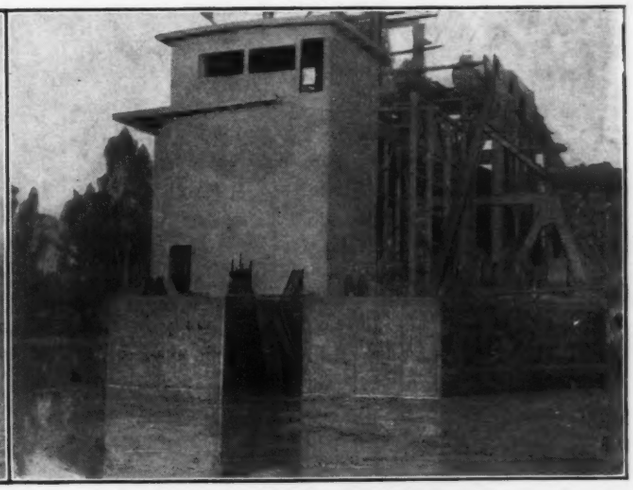
Natoma No. 4 dredge in Natoma field, American River district, California, under reconstruction with steel hull and 15-cu.ft. buckets, is the first gold-placer dredge to be equipped with two conveyor-belt tailings stackers and double-deck tail sluices. The purpose of the double-stacker equipment is the reclamation of placer ground for agricultural uses, coincident with the process of recovering the gold, by distributing the tailings uniformly over the width of the pond and depositing the fine material and soil on top, leaving the ground practically level behind the dredge. The arrangement of the stackers and tail sluices was suggested and designed under supervision of L. D. Hopfield, manager of the gold-dredging department, by C. M. Romanowitz, mechanical engineer, and approved by Emery Oliver, general manager of Natomas Co. of California.

Natoma No. 4 was originally Folsom No. 4, put in commission in November, 1905, and operated by the Folsom Development Co. until January, 1909, when it was taken over, with three other Folsom dredges, by the Natomas Consolidated of California (now Natomas Co.). The old boat was built with a wooden hull and equipped with 60-c.c. 13-cu.ft. buckets and dug an average depth of 22 ft. below water line. It was then the largest gold dredge known, being the first one equipped with 13-cu.ft. buckets and a double bank of gold-saving tables. It finished digging out its ground in the west end of the field in the last half of 1914, and the dismantled machinery was moved to Nimbus, in the eastern end of the field, alongside of the Southern Pacific tracks, where the reconstructed dredge will begin digging.

Natomas Co. is reconstructing the dredge with its own shop force and providing the smaller parts. The riveting of the hull floor started Aug. 28, 1915. The steel portion of the hull was completed and ready for laying the wooden deck on Sept. 4. The hull and superstructure, including part of the housing and the winches and bow gantry footings, were completed Oct. 9. Water was started into the pit on Oct. 28. The foundation was removed and the dredge floated on Oct. 31 at 5 p.m. It was expected to start digging at the beginning of 1916.



HULL OF NATOMA NO. 4, SHOWING SAND BLASTING



THE COMPLETED DREDGE AFLOAT

The Natomas shop is equipped for turning diameters not to exceed 48 in., so the larger parts of the necessary new equipment have been machined by other manufacturers. All the steel castings were made by the Columbia Steel Co., of San Francisco; the iron castings by the Stockton Iron Works. The Union Machine Co., of

*Associate editor, San Francisco, Calif.

San Francisco, machined all the larger castings (except the idler) such as the bull-gear rim, ladder-hoist winch castings and screen rings. The bucket idler was machined by Joshua Hendy Iron Works, San Francisco. The digging ladder and stackers, spuds, sluices and revolving screens were built by Ralston Iron Works, San Francisco. The ladder hoist winch was built in Natomas shops. The side-line winch, taken from an old head-line boat and repaired in Natomas shops, was designed so that the dredge can be operated either on the head line or on the spud. There is practically very little difference in the operating equipment of this boat and a standard steel-hull dredge, except for the two tail sluices and the two stackers. These parts comprise the only extra material.

Yuba Construction Co., Marysville, built the pumps. There are two 14-in. high- and low-pressure pumps, the high-pressure used inside the revolving screen, the low-pressure on the tables; one 6-in. two-stage hopper and cleanup pump, new type for dredge work; two single pumps, one discharging into the other.

The electrical equipment is composed both of Westinghouse and General Electric types. All the motors except a new one for the high-pressure pump were taken from old No. 4 dredge or from Natomas stock.

Details of the Hull and Preservation Methods

The steel hull was built by Johnston Bros., at Ferrysburg, Mich., set up and knocked down in the usual way and shipped in parts. It weighs 475 tons. The total weight of the dredge, including all machinery, is about 1,600 tons. The hull is 112 ft. molded length, which is 10 ft. longer than old No. 4; 52 ft. wide on the water line and 11 ft. 6 in. deep. The wooden deck, built of 4x6-in. material, is 62 ft. wide, including 5 ft. overhang on each side. The corners of the deck are provided with $\frac{5}{16}$-in. steel deck plates. The housing is of wood and extends to the full width of the deck and in length, from the stern forward to the point of slope at the bow.

The hull was sand-blasted only on a small portion, as it was found that it would take too long to finish the whole hull unless several machines were used. The surface was not painted in the fabricating shops and had rusted enough to permit the removal of the scale by using wire brushes. The hull was painted one coat of bitumastic solution and then one coat $\frac{1}{16}$ in. thick of bitumastic enamel, under contract, by the Hill-Hubbell Co., of San Francisco. The sand-blasted area will serve as an experiment for future work, to determine whether sand-blasting is necessary.

Floor-beams of the hull are 15-in. 33-lb. channels; deck beams, 10-in. 15-lb. channels; side frames, 8-in. 11.25-lb. channels. The well hole is 53 ft. 5½ in. long, 7 ft. 6 in. wide in the clear, and lined with ½-in. plates; 1-in. plates are used for chafing strips. The main truss is mostly of 15-in. 33-lb. channels. The bulkheads are built of ¼-in. plates reinforced by vertical angles.

The bow gantry is of the same design as Nos. 7, 8 and 10 dredges in the Natoma field, constructed of plates, angles and channels. It is 4-legged, standing in 4 separate deck footings built on foundations extending from the floor of the hull to the deck. The gantry is 52 ft. high, measured from the deck floor. The two spuds are each 61 ft. long, 30 in. wide, 42 in. deep, of the box-girder type. The digging spud is on the center line of the stern. The hull is reinforced at the stern, back of the spud. The stepping spud is toward the port side 13 ft. from the digging spud.

The digging ladder is box-girder type, of the same design as on the standard steel dredges, 91 ft. long, 8 ft. deep, 5 ft. 2 in. center to center of girders. The digging-ladder back hanger is changed from the standard type by using 2¾-in. cable for ladder back-hanger suspension, which gives better service than the eye-bar type, owing to flexibility, and is more economical in initial cost and repairs, as old cables too short for other purposes are thus made use of. The front hanger is of the usual eye-bar type. The rest of the hangings are about the same as on the standard all-steel dredges. The ladder is designed to dig 40 ft. below water line.

Data of Tumblers and Idlers

The lower tumbler is of the round type, 5 ft. 6 in. diameter, and the shaft is 13½ in. diameter. The upper tumbler is 6-sided; shaft, 20 in. maximum diameter. This tumbler is in one piece with the exception of wearing plates, cushion plates on bottom and ear plates on side. The cushion plates taper from 3 in. to 2 in. thick.

FIRST BUCKET IDLER CAST IN ONE PIECE

The bucket line is composed of 67-c.c. two-piece manganese steel buckets, 15-cu.ft. capacity and 3-ft. 3¼-in. pitch; they weigh 3,900 lb. each. The bucket pins are 6¼ in. diameter, 2 ft. 11 in. long. The two-piece bucket is now used on all Natomas dredges. The buckets on No. 4 are about 550 lb. lighter than the standard 15-cu. ft. buckets and are made so for the reason that the dredge will dig in lighter ground than other boats of the same capacity. This permits the use of lighter buckets and certain other operating parts, and is in accordance with the practice followed in California dredge construction, of building to meet the demands of the ground as shown by the prospecting drills.

The bucket idler is cast in one piece and is the first one-piece idler cast in North America and probably in the world. It is believed that the one-piece type will give better service than the usual four-piece type, as

there are no bolts and nuts liable to breakage. The idler is 9 ft. diameter and 6 ft. 11¼ in. wide through the hub; the shaft is 9 ft. 8¼ in. long and 9½ in. diameter.

The bull wheel is 12 ft. 8¾ in. pitch diameter, 14¾-in. bore and has an 11-in. face. The main drive pulley is 144 in. diameter, 25-in. face, 24-in. drive belt. The main drive is driven through ladder-hoist winch by a 300-hp. Westinghouse motor.

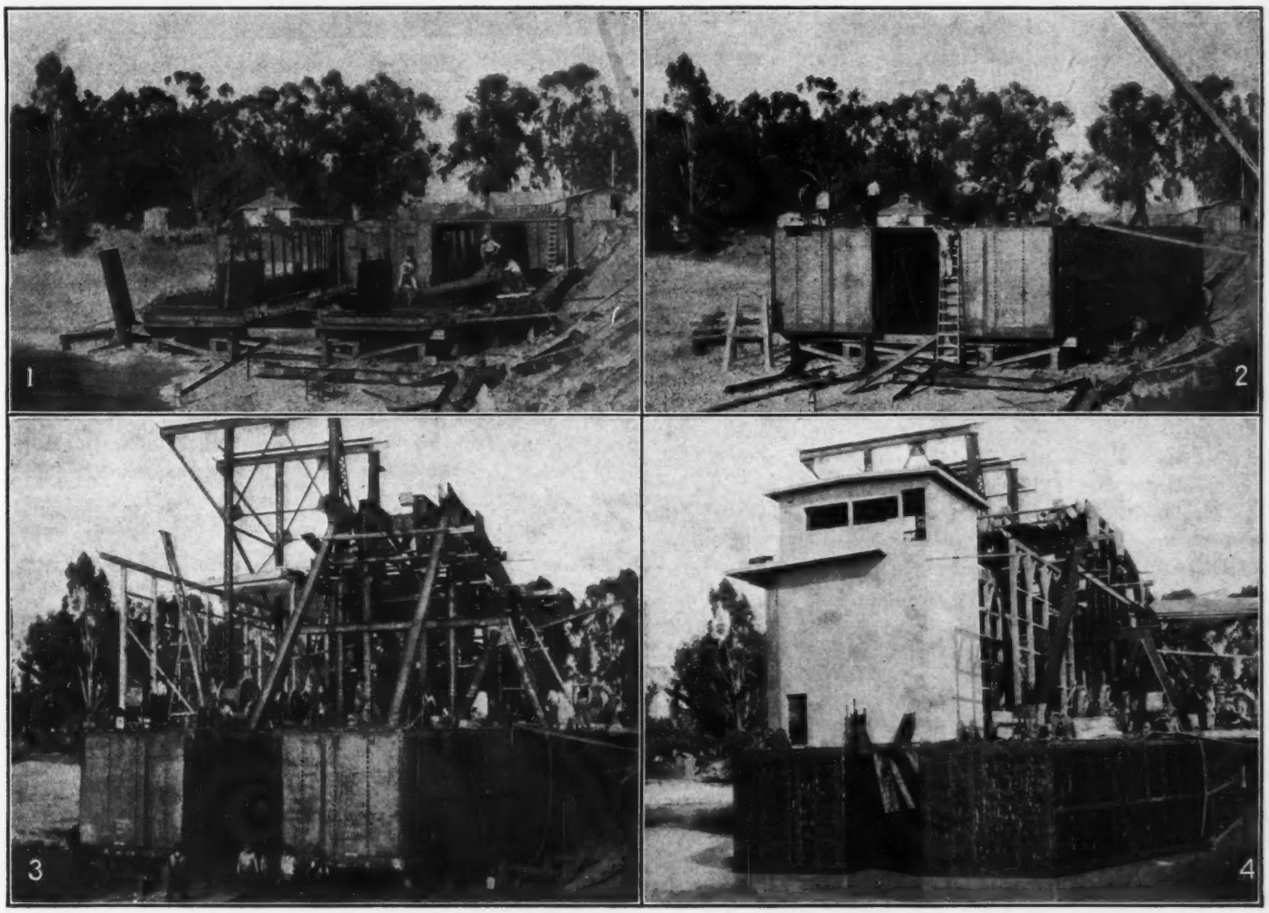
The hopper is of the same general design as used on the standard all-steel dredges and is built of ¼-in. shell plate and ⅜-in. liners. The saveall is changed from the old type. Instead of discharging through the well hole, it will run back underneath the screen and distributor, and discharge out alongside one of the stackers. This gives a larger area for gold saving, making it easy in the cleanup.

The Screens and Stackers

The revolving screen is the same type as used on the standard boats; 9 ft. inside diameter, 36 ft. center to center of tread rings and total length, 42 ft. 11¾ in. Four sections are perforated with ½-in. holes on the outside and ⅜-in. holes on the inside. The distributor is practically the same design as on standard dredges, but with some modification providing for better distribution of material.

The two gravel stackers are alike, made up of 18-in. channels. They are each 56 ft. long, center to center of drum. Each is provided with a 36-in. belt. All other parts are of the same general design as on standard dredges. The difference is that the standard stackers are generally elevated at about 18° from the horizontal, while the elevation here is only 1 in. in 12 in. The stackers are placed on each side of the digging spud on footings set on the deck floor, which provide for adjusting horizontally or vertically. There are two double-deck tail sluices placed near the corners of the stern. The upper decks of the tail sluices are each 66 ft. long; the lower ones 50 ft. long. All the sluices are 5 ft. wide. They are supported at the upper end on castings set on a steel box 5 ft. 7¾ in. above deck and so designed that the sluices can be adjusted horizontally or vertically as may be found necessary, just as the stackers are adjusted. The distance between the upper and lower decks of the tail sluices is 2 ft. 6 in.

The gold-saving tables are of wood with standard riffles. The only difference in construction of these tables and the standard is that upper and lower banks of these tables are set 2 ft. 6 in. apart. The main reason for this is to get proper clearance at the end of the tail sluices. In order to clean up the under tables, every other sluice on the under side is left out and a board walk put in for the cleanup. All the machinery is raised high enough to give proper headroom at the end of the tail sluices. At the end of the gold-saving tables there is a gathering sluice which collects the material and puts it into the tail sluice. The material coming on to the stackers comes



FIGS. 1 TO 4. CONSTRUCTION OF NATOMA NO. 4 DREDGE, AMERICAN RIVER DISTRICT, CALIFORNIA

Fig. 1—Floor beams in place. Fig. 2—Completed steel portion, ready for laying wooden deck. Fig. 3—Hull and superstructure; housing frame on starboard side. Fig. 4—Dredge completed and water started in pit

from the screen, distributed equally to the two stackers by a double hopper designed especially for equally dividing the material. The rocks or large gravel goes out on the two stackers.

The purpose of the drop of 1 in. in 12 in. in the tail sluices, which do not have riffles, is to make sure of a good flow of the material. The material from the lower bank of tail sluices falls on the rocks or large gravel which is spread uniformly by the stackers on the bottom of the dredge pond. The material from the upper deck of tail sluices will be deposited about 16 ft. to the rear of the point where the lower decks of sluices deposit, and act as a top soil. If either the stackers or tail sluices are found to be working improperly, they can be readily adjusted without hindering the operation of the dredge, and if the tail sluices are giving too much flow to the material, they can be elevated.

Provision for Even Distribution of Tailings

The design of the stackers and tail sluices provides for even distribution of all the material after the gold has been recovered, and unless there may be found some defective mechanical arrangement, there appears to be no reason why this dredge should not successfully solve the problem of replacing the gravel and soil in condition for the best of agricultural uses. This has been done on Butte Creek in Butte County by the application of the same principle, but different design. The Butte Creek

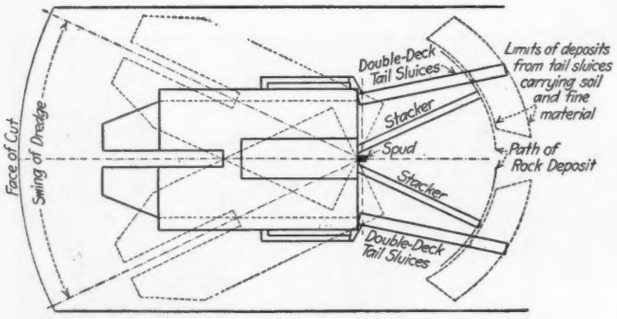


FIG. 5. SKETCH OF DREDGE OPERATING PLAN

dredge discharged the rocks or heavier gravel directly from the revolving screen through chutes on either side of the dredge; the finer material was passed through a single tail sluice provided with riffles for recovery of the gold and also with an undercurrent or lower deck.[1]

The Natoma No. 4 design is obviously an improvement upon the Butte Creek dredge, as it retains the practice of recovering the gold on standard gold-saving tables and provides a more practical method of distribution of tailings, not only by use of the two stackers and double-deck tailing sluices, but by the provision for horizontal as well as vertical adjustment of the stackers and sluices.

M. & M. Society of America at Washington

The following item is from the *Congressional Record* of Jan. 6, under "Senate Proceedings":

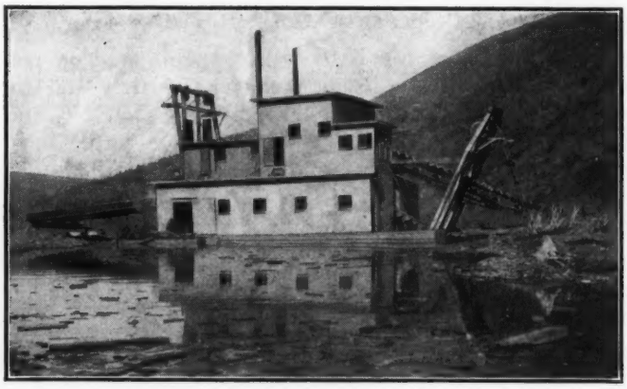
Mr. Smoot—I offer a partial synopsis of the conference of the Mining and Metallurgical Society of America, held in the auditorium of the Smithsonian Institution on Dec. 16, 1915, with a view to having it printed as a public document. I ask that it be referred to the Committee on Printing for action. In that connection I wish to say that the Bureau of Mines has informed me that it has a list of 8,000 operators to whom it desires these proceedings to be mailed. I shall ask the Committee on Printing to authorize the printing of 10,000 copies of this document.

The Vice-President—The paper will be referred to the Committee on Printing.

Since then the Senate has decided to reprint the proceedings of the conference, and it will be out in a few days.

A Locomobile Dredge

A dredge embodying some unique features in its power plant was built by the Union Construction Co., of San Francisco, for C. J. Berry, and has been installed on Mastodon Creek near Circle City, Alaska. This dredge has a capacity of 2,000 cu.yd. per day and is capable of



DREDGE WITH LOCOMOBILE-POWER PLANT

digging ground 15 ft. in depth. It is equipped with 3½-cu.ft. buckets.

The power plant consists of two 85-hp. Wolf locomobiles, providing a compact installation of high efficiency. The consumption of wood fuel has been found, by careful observation, to average 3.42 cords per day of 24 hr. The illustration shows the dredge at work.

Appropriations for 1916 for the Bureau of Mines

The following table shows the Bureau of Mines appropriations for the current fiscal year and the estimate for the fiscal year 1916-17:

	Appropriations, 1916	Estimates, 1917	Increase	Decrease
General expenses, Bureau of Mines	$70,000	$74,800	$4,800	.....
Investigating mine accidents	347,000	347,000	.....	.....
Testing fuel	135,000	135,000	.....	.....
Mineral mining investigations	100,000	100,000	.....	.....
Investigations, petroleum and natural gas	35,000	70,000	35,000	.....
Mining experiment stations	.....	75,000	75,000	.....
Removing mining experiment station, Pittsburgh, Penn.	57,300	42,700	.....	$14,600
Care and maintenance, new buildings, Pittsburgh, Penn.	.....	17,220	17,220	.....
Purchase of three additional mine rescue cars.	.....	53,280	53,280	.....
Equipment of three additional mine rescue cars.	.....	13,500	13,500	.....
Operating new mine rescue cars	.....	54,810	54,810	.....
Inspecting mines in Alaska	7,000	7,000	.....	.....
Books and publications	1,500	1,500	.....	.....
Land leases, etc., for mine rescue cars	1,000	1,000	.....	.....
Totals	$753,800	$992,810	$253,610	$14,600
Net increase			$239,010	

[1] "Eng. and Min. Journ.," Nov. 16, 1912, p. 935.

Bolivian Mining in 1915

By P. F. Bliek* and M. G. F. Söhnlein†

SYNOPSIS—Tin mining is one of the most important industries of Bolivia, the production showing an increase in 1915 over 1914. Copper mining is second in importance, and the mineral production includes considerable quantities of other ores, including bismuth, antimony, silver and gold.

After the depressed condition of the tin-mining industry during the last five months of 1914, a revival came in the first part of 1915, when exports of tin concentrates could be resumed because of the removal of difficulties in marine transport and the reëstablishment of a regular market for tin ore in England. The production was soon stimulated by stiffening of prices on the London market, but toward the middle of the year exports declined owing to the large stock of tin ore in Liverpool, the decrease in the price of the metal and the difficulty of selling low-grade concentrates. These factors again changed in October, and nearly all the tin mines are now working at full capacity. No exact figures are available as to the exports during 1915, but they are estimated to reach 42,000 metric tons of concentrates carrying 60% metallic tin, against 37,260 tons in 1914 and 44,600 tons in 1913.

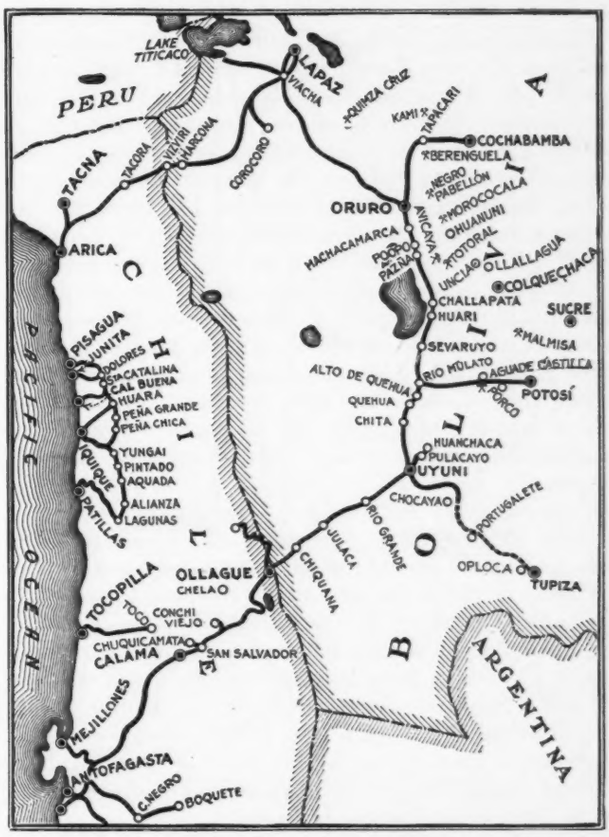
Probably the tin production will increase for the next five years, on account of the general introduction of modern machinery that will allow treatment of higher tonnages and a better recovery of the metal from the ores. Further, the new railroads built during the last year and those now under construction will have an important influence, giving better access to the mining centers of Uncia-Llallagua, Berenguela, Potosí and Chorolque-Oploca. The new railway from Arica to La Paz has considerably lowered the freight rates to the coast, so that at present it is cheaper to ship concentrates from Oruro and Machacamarca—where all the Uncia and Llallagua ore is now delivered by the private railroad of Simon I. Patiño—via Viacha-Arica, then via Antofagasta or Mejillones. On the other hand, it seems doubtful whether the production of Bolivia will rise to more than 60,000 tons of concentrates per year in the near future, because several of the main producers can keep their production at the present level only by modernizing their methods of mining and dressing, being obliged to work poorer ores on a larger scale because the richer parts of the mines are nearing exhaustion.

Few New Tin Deposits Opened

New tin mines of importance have not been opened during the year, and it seems, considering the experience of the last five years, that new tin-mining districts will be slow in showing up. Some work has been done at Malmisa, about 100 km. north of Potosí, without visible results. The mines of Pujo, to the southeast of Uncia, were being developed by Simon I. Patiño, but work has been stopped since the outbreak of the war. The Kami district, northwest of Cochabamba, has entered the list of producers with about 200 tons of concentrates per annum. On the other hand, Negro Pabellón, 20 km. east of Oruro, has practically died and the Berenguela mines do not yet show much progress. The same applies to the Quimza Cruz region, south of La Paz. The Morococala mine, near Huanuni, and Chocayay (Oploca), near Uyuni, have considerably increased their production.

Among the tin producers the Salvadora (Uncia) mine of Simon I. Patiño maintains the lead with a production of about 10,000 tons of concentrates per year, closely followed by the Compañía Estañífera de Llallagua, working the same deposits on the other side of the mountain, with a production of over 7,000 tons.

Mining in general has been favored by the low exchange rate of the Bolivian currency. In the beginning of the year the value of the Bolivian dollar fell to 14 7/8d. ($0.29), the official rating being 19 1/5d. Through the increase of exports and the reduction of imports, exchange slowly rose during the year to 16½d. with a probability of going higher still, as will be explained further on.



MAP OF BOLIVIA SHOWING PRINCIPAL MINING CENTERS

Another factor that helped the mining industry during the worst months of the crisis was the lowering of the wages for miners and common laborers, as has been pointed out before. This favorable situation, however, is rapidly passing; high prices for wolfram and antimony ores have drawn a lot of people from the tin mines, and the resumption of work on the Chilean nitrate fields has had a strong influence on the labor market. With the

*Manager, Cia. Minera de Oruro, Oruro, Bolivia.
†Mill superintendent, Cia. Minera de Oruro, Oruro, Bolivia.

higher prices of tin prevailing at present, it is to be feared that the tin mines will soon suffer from the same shortage of labor with corresponding high wages as in 1912-13.

A number of new laws recently promulgated will unfavorably affect the mining industry. In the first place should be mentioned the law intended to raise the exchange of Bolivian money, which obliges the tin producers to sell 10% of the London drafts they receive in payment for their metal to the Banco de La Nación Boliviana, the official bank of the country, at the rate of exchange fixed by this institution. The government recently proposed to raise the obligatory transaction of drafts to the amount of 20% of the total, and this law is at present under consideration by Congress. Heavy obligations which the Bolivian government has to meet in Europe and the United States will tend to the acceptance of this modification.

Smelting of Bolivian Tin Ore

The elimination of the competition of the German tin smelteries and the closing of several small English and French plants has been a serious matter to Bolivian ore producers. The large smelting concerns in England continued to buy tin concentrates, but of course only selected the best qualities on the market and raised their return charges from £10 to £16 per ton of 60% concentrates, retaining the usual sliding scale of 5s. per unit. Ore of lower grade than 65% or with undesirable impurities was practically unsalable, and this latter condition has induced several mining concerns to improve the quality of their concentrates so that at present a much larger percentage of Bolivian shipments contain between 66 and 68% metallic tin than formerly. In most instances better concentrates can be made by installing fine-grinding machinery and a little additional dressing equipment.

A new smeltery built by the American Smelting and Refining Co., at Perth Amboy, N. J., is about to be started. The ore supply has been contracted for a certain time from the Llallagua and Oruro companies, and other producers may follow. The establishment of this smeltery is a great benefit to the Bolivian tin-mining concerns, since it will deliver them from the uncertainty of sending tin ore to England where it may lie for months before being smelted. Although the return charges of the American smelter are about the same as those paid in England, ocean freight and insurance are considerably less to New York than to Liverpool.

The building of a smelting works in this country has been seriously considered, since electric smelting seems to be feasible. Early in 1914 French capitalists studied the possibilities of erecting in Bolivia an electric smeltery that would receive its power from a large hydro-electric installation. The scheme was worked out in detail and was reported to involve a capital outlay of 32,000,000 fr. ($6,000,000), but while it was being studied by the government the war broke out and the plan had to be withdrawn.

In November, 1915, two American citizens (J. C. Berry and J. Luitweiler) supposed to represent strong interests in the United States made a similar proposition to the government, and their scheme would have been well received by the tin-ore producers but for their demand to double the export taxes on tin concentrates, leaving the taxes on tin bars at their present level. If this had been granted, the tin-mining industry would have been placed at the mercy of the new smelting concern, because all competition of European and American smelters would have been barred by the high export duties on tin ore. On account of the strong opposition of the tin miners, Messrs. Berry and Luitweiler have withdrawn their claim to have the export taxes on tin concentrates doubled, and their proposition is now under consideration by Congress. Water power in the department of La Paz or in the northern part of the department of Potosí is to be used for the electric furnaces, and the company is to have the monopoly to smelt tin ore for a period of 25 years, besides a number of favorable conditions, such as exemption from all duties and taxes and reduced railway freight charges. The tin-mining industry would doubtless be aided by the installation of a national smeltery, provided its commercial and technical management were in capable and experienced hands.

Copper Mining Takes Second Place

Copper mining ranks next in importance to tin mining in Bolivia. The Corocoro district is the chief producer, and its output is increasing since the Arica La Paz railroad affords such cheap transportation of products and supplies. The Corocoro United Copper Mines Co. has asked the Chilean government for permission to erect a copper smeltery at Arica. During 1914 exports amounted to 3,874 metric tons of copper concentrates of 80 to 90% and 4,793 tons of ore rated at 40 to 50%. A few copper properties in Carangas and at San Vicente have been of late examined by American engineers, but so far no new copper-mining companies have entered the field.

Bismuth is produced at a rapidly increasing rate by the mines of Aramayo, Francke & Co., at Chorolque and Tasna, and smelted at Quechisla and Buen Retiro respectively. The total production in 1914 amounted to 437 tons of impure bars and 112 tons of ore, estimated to have a total value of $1,200,000. Most of this product is shipped to Great Britain, but before the war part of it was refined in Germany and Belgium.

Not more than two years ago the value of the silver production was second only to that of tin, but now it is surpassed by both copper and bismuth. The production of the metal is declining, partly owing to the competition of the tin mines on the labor market and, further, because the chief producer, the Cia. Huanchaca de Bolivia, which owns the famous Pulacayo mines, near Uyuni, had to reduce its output on account of heavy inflows of water into the mines, which the pumping plant could not cope with.

Silver is at present mined only in combination with other metals—in Pulacayo with zinc and in Oruro and Potosí with tin. The silver is recovered by lixiviation with hyposulphite or brine, after the ore has been given a chloridizing roast, and is subsequently precipitated from the solutions as silver sulphide or cement silver, which is shipped. A few operators have had tests made with a view to substitution of hyposulphite lixiviation by cyanidation, but in most cases the ores are of such a refractory character that consumpton of cyanide is prohibitive. This seems to be largely due to the considerable amount of antimony, often passing 5%, of Bolivian silver ores.

Production in 1914 was 2,300,000 oz. of fine silver against 4,600,000 oz. in 1910. Half of this was produced

by the Huanchaca Co.; the Oruro mines, which are owned by different Chilean companies, contributed 780,000 oz., and the rest was derived from the famous Cerro Rico de Potosí. In the southern part of the republic there are mines that have veins with silver and tin minerals of the same kind as those of Oruro and Potosí. At Chocaya the Cia. Minera y Agricola de Oploca and Aramayo, Francke & Co. have thus far treated this ore for tin only and shipped small amounts of picked silver ores, but lixiviation plants are now under construction. The Oploca Co. also owns the well-known mines of Portugalete, Tatasi and Choroma, which formerly produced large quantities of silver. These mines have been idle for many years, since they could not be profitably operated after the fall in price of silver. They will probably be reopened if a suitable process for extracting the precious metal is worked out. An attempt has been made to attract foreign capital to unwater the famous silver mines of Colquechaca, which have been flooded for more than 30 years, but apparently without any results.

Production of the Minor Metals

Since the middle of the year there has been much excitement over the high price of tungsten, and a good deal of prospecting for this metal has been done without disclosing new deposits of importance. The principal mines are at Quimza Cruz, in the province of Ayopaya, northwest of Cochabamba (Kami and Chicote) and near Uyuni, at Salasala. Exports during 1914 amounted to 276 tons of 60 to 65% concentrates, and in 1915 this figure will at least be doubled. In most instances the increased production has been derived from low-grade deposits that were known to exist, but could not be worked at a profit with normal prices. All the tungsten mines of the country are worked in the most primitive way, almost without machinery. A discovery of tungsten was recently made in partly worked-out stopes in the upper levels on the Llallagua property.

Exports of antimony ore have enormously increased during this year, having risen from only 187 tons in 1914 to several thousand tons in 1915. The grade of the ores shipped varies between 50 and 65%. It is principally mined in the Potosí region, and near Oploca, and occurs as almost pure antimonite in wide veins. Toward the end of the year antimony exports have diminished because the metal was less in demand with the local ore buyers.

Gold mining is still of small importance, although the production of this metal has shown an increase since American companies are operating the Inoa Oro and the Olla de Oro mines, both in the department of La Paz. The total production in 1914 amounted to 5,790 oz., of which about 3,500 oz. was produced by the two American-owned mines mentioned.

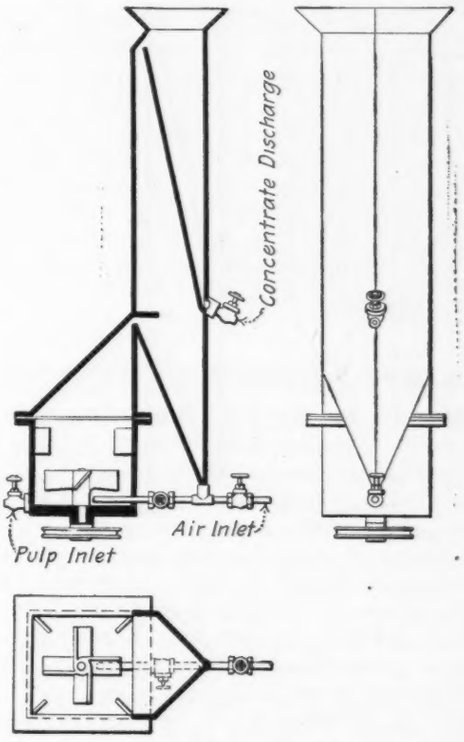
The production of zinc ore is declining, as the only producer, the Cia. Huanchaca de Bolivia, has diminished its output. In 1914 only 3,755 tons was shipped. A few mines in Sud Chichas near the Argentine border produce lead ore, which is exported to the Argentine Republic.

Women Employed in British Collieries in 1914 numbered 6,576, according to the British Mines Report. All were on surface work, as the law does not allow them to work underground. The number of boys employed was 76,399 in all, 53,402 underground and 22,997 on the surface.

The Wood Flotation Machine

The flotation process of concentration has become so popular that many efforts are being made to develop and improve it. Some operators are now attempting to accomplish flotation of the sulphides without any oil. Of course that system is not altogether new, since the Potter process depends upon floating sulphides by means of the gas developed in acid solutions.

A new system is now proposed and has been patented by Louis A. Wood, together with Minerals Separation, Ltd., of London, and has received British Patent No. 10,312. In this process the bubbles are formed of air which is injected into the pulp, mechanical agitation also being applied. The apparatus proposed for this process is shown in the accompanying drawing. A paddle agitator is provided, as shown, the pulp entering from one side and air from another. The whole mixture is forced upward and through the small opening into the



THE WOOD FLOTATION MACHINE

first chamber, where a middling is formed, which settles back into the air pipe and is forced again into the agitating chamber. The upper chamber receives the clean sulphides, which are floated nearly to the top of the machine.

It is a fact that air bubbles containing sulphides and without any oil, will not persist at the surface of the pulp, but will break at or below it. To receive this sulphide concentrate the upper chamber with the inclined bottom is devised. The concentrates are drawn off through the valve at the apex of this chamber.

Agitation and air injection are at such a rate that the barren gangue will not pass out of the agitating chamber. A special opening near the bottom of the chamber is provided, to draw off the tailings. The accompanying drawing shows clearly the construction of the apparatus.

Mining and Metallurgical Society Meeting

The eighth annual meeting of the Mining and Metallurgical Society of America was held at the Engineers' Club, New York, on Tuesday, Jan. 11, W. R. Ingalls, president of the society, presiding. In the afternoon session matters of business were transacted. The secretary and treasurer made their reports, and the president delivered an address, summarizing the participation of the society in the second Pan-American Scientific Congress and reporting its activities toward securing through Congress a revision of the mining laws of the United States.

The result of the election of officers of the society for 1916 was reported as follows: President, J. R. Finlay; vice-president, Waldemar Lindgren; secretary and treasuser, Louis D. Huntoon; members of council, W. R. Ingalls, R. A. F. Penrose, Seeley W. Mudd and Charles W. Goodale.

The subject of the award of the annual gold medal of the society in 1916 was "distinguished achievement in the science of economic geology." Announcement was made of the award of the medal, by vote of the council, to Prof. James F. Kemp, of Columbia University.

Following the annual dinner, at which 46 members were present, reminiscences of South African experiences were related by Thomas H. Leggett, R. M. Catlin and H. H. Webb. Some graceful remarks were made by H. W. Gepp, of Broken Hill, Australia, after which the meeting adjourned.

Larger Output of Titanium

During 1915 the American Rutile Co. produced 250 tons of rutile (titanium dioxide) worth between $25,000 and $30,000, at its plant at Roseland, Va., the largest production to date. A considerable quantity of ilmenite (titanium-iron oxide) was produced as a by-product. For a number of years this firm has been the sole producer of rutile in this country. Attempts have been made by others to develop deposits in Hanover and Goochland Counties, Va., and near Magnet, Ark., but no commercial production has yet been made at these places, says the United States Geological Survey.

Rutile and ilmenite are both used in the manufacture of ferrotitanium, which is employed in making steel and cast iron. Both are used in making electrodes for arc lamps, but for some reason ilmenite from other sources than the foregoing does not seem to give the same satisfaction. Rutile is the source of titanium for making cuprotitanium for use in brass and other copper-bearing alloys and for making potassium titanium oxalate, used in dyeing leather and textiles. A little rutile is also used in ceramics and for coloring false teeth.

First Aid in California

S. C. Dickinson, first-aid miner of the United States Bureau of Mines, has been giving first aid instruction at some of the California mines, the Industrial Accident Commission paying his expenses and the Bureau of Mines his salary.

Between the middle of October and the end of December, 1915, he visited the following mines: Eagle Shawmut, Santa Ysabel, Dutch-App, Harvard and Jumper, in Tuolumne County; Melones, Gold Quartz, Utica, Union Copper, Hodson and Campo Saco, in Calaveras County; Union Hill, in Nevada County; and Reid and Mammoth in Shasta County. He also visited gold dredges at Hammonton.

Quarry Accidents in the United States During 1914

According to Technical Paper 128, U. S. Bureau of Mines, the total number of men killed in quarries during the year 1914 was 180, which is at the rate of 2.05 per 1,000 men employed, compared with 1.72 for 1913 and 1.88 for 1912. Although quarry work is done chiefly in the open, yet falls of rock or overburden caused 29.45% of the fatalities reported for 1914. The accidents from explosives were about the same number and together represented about one-half of the fatalities; haulage is third, with about 20%, and falls of persons is fourth, with 9 to 13%.

In France the fatality rate from quarry accidents is seldom more than 1 per 1,000 men employed. In Great Britain for 10 years, 1895 to 1904, the rate was 1.09 per 1,000 men employed, and in 1913 it was 1.05. The higher fatality rate in the quarries of the United States probably results from less stringent regulation and less systematic inspection.

Mining Engineers' Program, February Meeting

The introduction to the announcement of the A. I. M. E. meeting this year (Feb. 14-17) would be sufficient without the further details of the papers which are given. This introduction is as follows:

This folder is meant to be read; take it home with you and let your wife read it, too.

We want you to come to the New York meeting of the Institute this year.

We are doing things in a new way, and it is because of this change that we want you to attend and to tell us if you like it.

In the first place, the idea is to make the meeting more informal, to get better acquainted with one another, and to have a good time while we are getting acquainted.

There will be the usual program, of course—technical papers of great interest; discussions by prominent men, as we have always had them.

But this year we have planned a series of college reunions, where you can meet your old classmates. We tried this last year and were very successful. This year we have gone a step farther. If you are interested, write us about it.

We have planned an excursion that will meet with your approval: The Navy Department has promised us a boat for the day and will take us to the navy yard and to the Sandy Hook proving grounds. You cannot afford to miss this. Does not cost you a cent.

We will have a smoker with several new features for one evening. We can promise you an extraction of 98% on this evening's entertainment.

And the ladies' committee has some plans that will interest your wife. There are excursions, theater parties, visits to art galleries, afternoon teas, thées dansantes—all free to out-of-town visitors. Does your wife want to go shopping? The ladies' committee will see that her wishes are gratified.

Expenses? Do not worry about it. There are plenty of hotels in New York City, really first-class hotels that you never heard of, where you can be very comfortable without feeling that your bills are outrageous.

If there is anything you want to know about this meeting, any arrangements you would like to make, any people you would like to meet, write us and we will see that you are taken care of.

A detailed list of the papers will be printed later.

Mining in Idaho

By Robert N. Bell*

SYNOPSIS—High metal prices encouraged wide exploration in Idaho in 1915, showing ore in formations not heretofore regarded as of commercial importance. The Interstate-Callahan has put Idaho on the map as a large zinc producer, while the Coeur d'Alenes are turning out more lead than ever before.

The rapid advance in base-metal values brought about by the European War during 1915 proved the greatest stimulus to mineral production and new mining development activity in Idaho and has demonstrated, to a marked degree, the potency of Idaho metal and mineral resources in general that argues well for continued expansion in annual yield and in particular puts this state on the map as a permanent and important source of zinc ore.

The Cœur d'Alene district continues to afford the state's sensation in new ore development. The total metal yield of the state had a gross shipping value of about $38,000,000 and afforded net profits on its extraction of fully $9,000,000. The most conspicuous profit-sharing enterprise was a new zinc mine owned by the Consolidated Interstate-Callahan Mining Co., and situated about 8 mi. north of Wallace. This property is well within the Prichard slate formation, a division of the Cœur d'Alene sediments that for 10 years past has been rather discredited as a probable source of profitable orebodies. Of course the excessive market value of zinc during the year was the big factor in the profit end of this mine's operations, which amounted to over $2,500,000 on a daily yield of three to four hundred tons of mill feed.

Interstate Ore Channel Proved 1,800 Ft. Deep

The ore channel from which this remarkable result was obtained, as described in past publications, is fully 1,000 ft. long and carries a stoping width of 3 to 40 ft., while the mine run of its stopes, giving a yield of fully one ton of concentrates and crude hand-picked ore to two tons of mine output, is the best result ever obtained in the operation of any Cœur d'Alene mine of equal capacity. This ore channel has been developed 1,800 ft. deep and is much stronger in the bottom than at its crest. It is only one of three important ore channels traversing the company's property, the other two carrying more lead.

This orebody, known as the Interstate shoot, is remarkable from the fact that it carries very little associated mineral with the zinc, excepting about 3% lead, from which a clean shipping product of lead concentrates is made averaging about 60% lead and 30 oz. of silver per ton. The freedom from other objectionable minerals of this remarkable zinc orebody should give it a marketable preference after spelter values again assume a normal level, and it should continue to be a profitable source of mining operation. The community value of this interesting new mineral deposit is the nature of its occurrence in the form of a tabular orebody in a sheared fissure with secondary short spurs of quartz and definite wall-rock replacement evidences, that have characterized the famous tabular lead-silver shoots in the adjacent Cañon Creek and Mullan mines in the quartzite that now exhibit some of their best ore phases at depth, ranging down to 3,000 ft. vertically.

This development opens wide possibilities of an expanding areal distribution of ore deposits, as the black Prichard formation in which it occurs has the largest surface distribution of any of the classified Cœur d'Alene sediments and probably carries as many surface prospects of ore as all the other formations combined.

A number of new development enterprises have been started or revived in the vicinity of the Interstate-Callahan propery, on Nine Mile and on the adjacent slopes of the north fork of the Cœur d'Alene River, also on the east fork of Pine Creek immediately south of Kellogg, where more or less extensive preliminary development operations exhibit at this time a dozen deposits that have equal or superior shallow development manifestations of zinc-lead ore to the now famous Interstate-Callahan bonanza. I believe that, with the added encouragement of a method of economically producing spelter in the Northwest, now definitely promised by the practical research work of the Anaconda company, the zinc resources of this region will have a competitive advantage over the more eastern resources of spelter by reason of the valuable byproduct metals of silver, lead and copper that will be made available in the treatment of this class of mineral in the Northwestern States.

Lead Production Retarded by Smelting Troubles

The lead production of Idaho, aggregating 370,000,000 lb. during the year, would have easily reached 400,000,000 lb. but for the smelter-market troubles, which kept two of the largest producers out of commission for three months of the year—one of them, the Hercules, the fattest resource of high-grade lead-silver mineral in the district.

The Bunker Hill & Sullivan Co., with two-thirds of its yield from its deep levels below the valley bottom, made the record output of its history in lead and silver, and in connection with the adjacent operations of the Stewart, Last Chance, Ontario and Caledonia mines, gave the Kellogg-Wardner division of the Cœur d'Alene field a combined output of over 6,000,000 oz. of silver and 165,000,000 lb. of lead, a remarkable result considering that a large portion of the tonnage treated came from a horizon between three and four thousand feet deep in the dip of the Bunker Hill vein.

The great Morning mine, at Mullan, owned by the Federal company, whose deepest level is being opened 3,400 ft. vertically below the apex of the orebody, continues to manifest splendid prospects of permanence and the biggest developed ore resources of its history, while some astonishing advances have been made by the present management in the treatment and successful separation of its complicated and base mineral product.

The deep levels of the Hecla mine have shown a remarkable expansion and continuation of the clean lead-sulphide mineral for which this deposit has always been noted, and the probable magnitude of this property is not yet fully appreciated.

*State mine inspector, Boise, Idaho.

The deepest level of the famous Hercules mine, now operated through a two-mile tunnel, continues to show a persistent expansion in length of its noted ore channel with the addition of new and virgin shoots of mineral of big productive capacity. Additional proved mineral territory in the technically forbidden Prichard formations to the west has, with rare foresight, been acquired by the Day brothers, the controlling owners of the Hercules. This family promises soon to become the dominant factor in Cœur d'Alene ore production and has been justified in entering the lead-smelting field. It has acquired what is known as the Northport smeltery in Washington and a refinery in the East. These operations will be started early in 1916 with a daily capacity of 250 tons of high-grade lead-silver concentrates and crude ore supplied from mines under its own control. This capacity can be maintained and largely increased for a long future from present proven resources.

As suggested 10 years ago, I am more firmly convinced than ever that the genesis of the Cœur d'Alene ore deposits, given as originating in a relatively shallow monzonite magma by Ransom in professional paper No. 62, is erroneous, and that the mineralization is much more ancient and likely much deeper seated than his conclusions would indicate and that it is related more particularly to a basic magma which produced the numerous narrow, and in some places quite wide, dikes of diabase and kindred basic igneous rocks for which the district is noted and which closely parallel the main ore courses. One of these dikes constitutes the line on which the Hecla vein was formed, and the ore is now conspicuously found on both walls of the dike and replaces its substance in the deeper levels. If this conclusion has any value, it may enormously expand the scope in depth and probable productive area of the Cœur d'Alene district, as these dikes are a persistent association of all the Cœur d'Alene sediments, especially of the Prichard formation. They are generally parallel to the main ore courses, while the monzonite cuts the course almost at right angles.

The copper production of the Cœur d'Alene district was greatly reduced by the exhaustion of the Snow Storm orebody down to a formation fault below which it has not been recovered. The National mine, operated on a similar character of ore to the Snow Storm, only started its new 500-ton mill in December. The ores of this mine have been found to be considerably lower grade than was anticipated, but are in the hands of one of the ablest operators in the district—James F. McCarthy. The enterprise gives considerable promise of becoming an interesting source of copper-mineral shipments in the future.

New Area North of Kellogg

Twelve miles north of Kellogg a new mineralized area is attracting attention on the Little North fork of the Cœur d'Alene River and gives evidence of adding another important source of copper and also lead-silver mineral production to the district. The Horse Powell mine at this point has opened an oreshoot consisting of a quartz lime and spathic iron gangue, 10 to 20 ft. wide, 400 ft. long and 200 ft. deep, from which carload sample shipments from the width of the vein have indicated an average value of 3% copper. This big oreshoot carries a quite uniformly disseminated chalcopyrite mineral. The walls of the vein are clean quartzite, and the fissure is persistent at the surface for over 2,000 ft. The property is in good hands and has recently been equipped with a 1,500-cu.ft. compressor, with which the development will be pushed in the anticipation and promise of warranting a large milling plant during the coming year.

Among the other Idaho mineral developments of note during the past year were the results obtained from the Idaho Continental mine, in Boundary County, a group of claims adjoining the international border between northern Idaho and British Columbia. This property has been developed 600 ft. deep by three adit tunnels. It is in thin-bedded pure quartzite resembling the Burke formation in the Cœur d'Alenes and is associated with intrusive dikes of diabase. It was equipped with a 200-ton mill, which began operations during the summer, but after producing 2,000 tons of 50% lead concentrates carrying about 30% to 40% silver per ton, this new plant was destroyed by fire. Through the energy of its local promoter, however, the mill has since been rebuilt and will shortly be in commission again. In the meantime the mine, in the hands of a practical Cœur d'Alene foreman, has been transformed into a remarkably promising resource of rich concentrating ore, with 20,000 tons already broken in the stopes and fully a thousand feet in length of oreshoots proven, carrying a stoping width from 2 to 15 ft. thick, with marked increase in silver values in the bottom level. As compared to the shallow surface development, the enterprise should prove an active shipper during the coming year.

Gilmore and Dome Lead Districts

Two other lead districts were actively operated in the central part of the state. One of these, the Gilmore district, had two producing mines that shipped a total of 10,000,000 lb. of lead contents in crude ore. These were the Pittsburg-Idaho and Latest Out mines. The former is developed to a depth of 650 ft. and shows the richest ore of its history in the deepest point opened. The formation is carboniferous lime and intrusive dikes of semibasic igneous rock.

At the Dome district in Fremont County the Wilbert mine was actively operated on a fissure in Cambrian quartzite and produced 600 tons of 50% lead concentrates and crude ore a month during the greater part of the year.

In the Wood River district several important new strikes were recorded among the old lead-ore deposits—one of them in the Lipman tunnel, at one of the deepest points reached in the district and supposed to be on the original channel of the Red Elephant vein. A 10-ft. body of rich lead-silver concentrating ore has been cut and is attracting a great deal of attention, as it seems to warrant a deeper development at a number of other points of former important production in this extensive district.

Other rich lead-ore strikes made in the Wood River belt were at the Carboniferous and Black Barb mines, on Kelly Gulch, and the Silver Fortune mine, on the east fork of Wood River. An active interest is also being taken in the zinc resources of this district, which are widely distributed and give evidence of considerable tonnage capacity when more fully developed. The North Star Triumph group, with a 100,000-ton resource of developed ore relatively rich in zinc, lead and silver, is being developed by Ralph Nichols and promises the basis of a good-sized operation.

The most important copper output of the state for the year was that of the Empire Copper Co., at Mackay, in Custer County. The manager of this company pursued a wise plan in the fall of 1914. With no market in sight for copper, he continued and extended an already established leasing system and guaranteed the living expenses of 100 men, divided over 40 or 50 separate leases, with the result that when the metal market improved in the spring, he was in shape to take advantage of it and made the record output and profit of the mine's history during the year. The monthly shipment during the summer from this mine reached 9,000 tons of about 6% ore containing gold and silver. This deposit is being prospected at an additional depth of 900 ft. through a crosscut tunnel now in 4,500 ft., which has recently entered the ore zone and found a good flow of water, together with altered lime associated with the garnet formation and shows, according to Umpleby, of the United States Geological Survey, encouraging geological evidence for the persistency of some of the numerous ore channels to this additional depth.

Lost Packer Smeltery Only Cleaned Up

At Loon Creek, in the county, the Lost Packer operated its smeltery for a short cleanup run of 55 tons of matte, containing 45% copper, nearly 9 oz. gold and 30 oz. silver per ton. This company has also completed the installation of a concentrating mill to treat its quite extensive resource of quartz ore, which was too siliceous for direct smelting. This new mill has a capacity of 50 tons per day, has 20,000 tons of measurable ore to start work on and should put the Lost Packer again in the list of important producers during the coming year.

Bonanza gold-ore values were developed and shipped from the old Montana mine, on Estes Mountain. This development was of sufficient importance to warrant the installation of a 1¼-mi. aërial tram to connect the mine with the Golden Sunbeam mill on the opposite side of Jordan Creek Cañon, in which the property lies.

The completion by the Intermountain Railway Co. of a first-class standard-gage railway extending from a short distance above Boise to a point near Centerville in the heart of the Boise Basin, and primarily built to transport logs to the big milling plant of an affiliated company five miles above Boise, has had the effect of greatly stimulating interest in the lode deposits of this famous placer gold district. At Grimes Pass quite an active interest is now being taken and a hundred men are employed in the development of a series of interesting quartz-pyrite fissures whose shallow development has been confined to the extraction of their free gold, for which they have been worked in a desultory manner for a number of years. One of these fissures is from 5 to 10 ft. thick, stands nearly vertical and is traversed by shallow surface work at short intervals for 9,000 ft. through a vertical range in its outcrop of fully a thousand feet. The deepest point of its development does not exceed 200 ft., where there is disclosed a pay streak from 1 to 3 ft. wide of high-grade soft chalcopyrite ore associated with a gray-black mineral similar to the glance and enargite mixtures of Butte, Mont.

Other veins in this vicinity in shallow development have shown very high silver-bearing gray-copper ore associated with lead in pay streaks from a few inches to 2 ft. thick. Still another phase of mineralization is a broad dike of diorite carrying a primary dissemination of coarsely crystalline lead sulphides. This is probably too low-grade on the average for profitable treatment as a whole, but contains narrow bands of clean galena giving good assays of gold and silver. Some of the veins of this district show a rich percentage of zinc sulphide. The base minerals are all associated with a relatively high tenor of gold and silver, and the situation seems encouraging, to say the least, for the birth and establishment of a new smelting-ore district for central Idaho. These mines are within 10 mi. of the new railway, which has been a big factor in stimulating interest in their development. Idaho placer districts as a rule are not noted for deep-vein mineralization, but there is one deposit on this particular zone—the Gold Hill & Iowa mine—that has produced three million dollars in gold from a maximum depth of 550 ft. under its lowest outcrop and the geological conditions of this particular belt are extremely favorable, consisting as they do of a zone two or three miles wide and twenty miles long which shows a conspicuous development of enormous dikes or zones of porphyry and rhyolite, together with smaller dikes of basic igneous rock.

The Seven Devils copper district was more active during the year than usual, and a number of cars of lease ore was shipped. The Red Ledge deposit of this district attracted the attention of an array of the leading copper talent of the country. It is idle at this time, but will be tested more fully by diamond drilling during the coming season, as some conflicting but interesting opinions have been rendered as to the importance of the big body of sulphide mineral that has been disclosed in its limited tunnel development. This body is 80 ft. thick and will average $5 per ton in gold and silver about equally divided, and 50 ft. of the unoxidized portion will average 4.6% copper.

On the Oregon bank of the Snake River Cañon in this same region, the Iron Dyke mine is being operated under lease and bond by a crew of 20 men and has already shipped several cars of crude ore to market.

Niter Produced in an Experimental Way

Interest continues to be manifested in the potassium and nitrate deposits of southwestern Idaho and eastern Oregon. Assay results in beds up to 40 ft. thick have been obtained, showing from 2 to 10% of these desirable salts and a small experimental plant has been built in the field by one of the promoting companies.

Very little activity was manifest during the year in the southeastern Idaho phosphate belt beyond the shipment of a few thousand tons of rock from the Waterloo mine and a continued effort to obtain title to a few of the privately owned claims that were located before the extensive government withdrawals were made.

Pure Iron by a New Method

What is said to be an entirely new method of producing pure iron has been discovered by Dr. Trygve Yensen, an assistant in the engineering experiment station of the University of Illinois. Doctor Yensen's discovery was made during his investigation of magnetic properties of iron and iron alloys. The university declined to permit a patent on the process to be taken out, believing the benefits should accrue to everyone. An announcement made at the university was as follows:

"The method used by Doctor Yensen consists of melting electrolytically refined iron in a vacuum, thus

reducing the impurities far below any point that had been reached by previous investigators. The magnetic properties of this vacuum-fused iron have proved to be as remarkable as its purity. Its maximum permeability, that is, measure of ease with which it can be magnetized, was found to be two or three times higher than for the best magnetic iron or iron alloy previously produced.

"A practical result of this investigation is that if it should turn out to be commercially profitable, the amount of material needed for electrical machinery, such as transformers, would be cut in two and the losses that occur continuously as long as the machine is in operation would be greatly minimized. The annual saving to the electrical industries of the country by application of this discovery will amount to between $15,000,000 and $20,000,000 if it should turn out that the iron can be produced at the same expense as the iron at present used."

Mining in Colorado in 1915

By George E. Collins*

Speaking generally, it may be said that 1915 was a prosperous year for Colorado metal miners. This was owing principally to the high prices of zinc and lead prevailing during the greater part of the year; and had the mines themselves received the entire benefit of the high metal prices, the resulting prosperity would have been more marked. The low price of silver largely offset the high price of lead, as the same mines usually produce both; especially as the miner suffered the full extent of the former, while being settled with on the basis of only part of the advance in lead. The pretext advanced was the higher cost of the zinc used in refining, but this is obviously an insufficient reason.

Zinc Mining Not a Flourishing Industry

As to zinc—except in the case of mines that had previously entered into definite contracts based on a sliding-scale varying with the selling price of spelter—ores could be sold for only a portion of the value of their zinc contents. This resulted in part from the fact that Colorado ores usually make only inferior grades of spelter; still more, because the distilling capacity of the smelteries was for the time utterly insufficient to handle the output of ore stimulated by high prices, actual or expectant. Furthermore, the interests that control the smelteries in many cases also control important producing mines; and they naturally prefer, at times of high metal prices, to reserve their retort capacity as far as possible for their own output or that of producers closely allied to them.

The Cripple Creek district made a good record for the year without the stimulus of high prices for its sole product—gold. Generally speaking, developments in most of the deeper mines, such as the Portland, Vindicator and Cresson, continues favorable, while the sensational bonanza uncovered at the Cresson a year ago indicates that a bold policy of prospecting at depth is justified. A feeling of optimism is general among the men best qualified to judge of the future of the district.

The Roosevelt drainage tunnel continues to discharge about 15,000 gal. of water per min. The breast is advancing at the rate of 10 or 12 ft. daily and is nearing the Elkton shaft.

*Mining engineer, Boston Building, Denver, Colo.

In April the Golden Cycle mine was sold for $1,500,000 to the Vindicator company, which had a lawsuit against it for $1,000,000 on account of alleged wrongful extraction of ore. In the succeeding month Stratton's Independence was sold to the Portland company for over $300,000. The Independence mine and dump were practically exhausted, and its mill was better situated for handling Portland dumps than the low-grade mill of the Portland company. It is stated that the Independence mill is being remodeled to use flotation on the dump ores. In other respects the prevailing milling practice of the district—roasting and cyaniding the high-grade ores, and cyaniding, with or without concentrating, the low-grade and dump ores—remains unchanged.

Leadville and the San Juan District

At Leadville there has been little change in the relative positions of the principal producers. The situation in the market for zinc ores, just referred to, has been acutely felt, but toward the end of the year the condition improved considerably. The machinery for the down-town drainage project arrived early in the year, and unwatering of the Penrose shaft is making good progress.

In the San Juan district the three great mines at Telluride continue active. The Tomboy, by judicious purchases of territory, appears to have extended its life indefinitely. The Humboldt group, which contains the extension of the Smuggler-Union vein, has finally been purchased by people connected with the latter company, and its ore will be treated at the Smuggler mill.

At Ouray the Crawford smelting plant has been operated most of the year by the Wanakah company. The Camp Bird has had yet another successful year and forms a remarkable illustration of how long a great mine may linger, even after it appears to be worked out. It is now planned to resume exploration in depth, which was discontinued several years ago in consequence of the Spurr report. At Silverton most of the mines are operated by tributers, with the striking exception of the Sunnyside. This property has derived great benefit from the high price of spelter and has enlarged its plant in preparation for increased activity.

In the northern part of the state the Idaho Springs district has had a fairly successful year and Gilpin County a relatively dull one. Georgetown also has experienced but little activity.

In Summit County the gold dredges have all produced well, and a new enterprise of this nature, on the Derry ranch near Leadville, has made a good start.

Outside Leadville the largest producers of zinc are the Wellington, at Breckinridge, and the Iron Mask, at Red Cliff. The first-named enjoyed a prosperous and profitable year; the latter was sold during the summer to the Empire Zinc Co., which, together with the American Zinc, Lead and Smelting Co., now controls the greater part of this important and promising district. Second to these, as producers of zinc, are the Sunnyside, at Silverton, and the Mary Murphy, at Romley, both of which are also heavy producers of lead concentrates containing gold and silver.

The most important new discovery was one of oxidized zinc ore at the Doctor, an old lead-carbonate mine in Gunnison County, from which, throughout the fall months, a large number of teams were kept busy hauling 30% zinc ore to the railway.

In Boulder County the tungsten industry has been extraordinarily active; the demand for high-speed tool steel, due to the war, having created a corresponding demand for tungsten ores. The price for tungsten concentrates, based on a product containing 60% tungstic acid, advanced from $6 per unit at the beginning of the year to over $40 per unit at its close, and quite low-grade ore became marketable. In this district most of the mining is done by tributers; the veins are numerous, but as a rule narrow and pockety. Irregular stringers an inch wide or less, such as in the early days of the district would not have been worth locating, are now being profitably worked, and many prospects around the fringes of the district, where the ore is usually of lower grade, have been reopened. Several of the known tungsten deposits in San Juan County, where hübnerite occurs in narrow veins with sulphide minerals, are also being worked for the first time in 12 or 15 years.

Molybdenite also is in great demand—many unimportant deposits of this mineral are known in Colorado, together with one or two important ones. Of these, one of the largest is situated at Summit, between Leadville and Kokomo; this is being worked by some Leadville men. Another large deposit is near Berthoud Pass, above Empire; this is controlled by the Primos Chemical Co. Work was, however, suspended for the winter in October, owing, it is said, to some legal dispute between the original owners, from whom the Primos people bonded the property.

Carnotite Mining Fairly Active

The carnotite deposits in the southwestern part of the state, having been inactive during the early part of the war, are now again productive in a small way, and the radium plant of the Federal Government in Denver is in operation. Little or nothing was done on the pitchblende-bearing veins of Gilpin County during the year. The vanadium plant at Placerville was operated successfully.

The strike in the coal districts, always unjustified by economic conditions, completely collapsed, but the coal market is dull and business unprofitable. A plan is proposed for the amalgamation of the independent coal companies, by which cutthroat competition may be eliminated. The Colorado Fuel and Iron Co., through John D. Rockefeller, Jr., has announced a plan for coöperation with its employees so as to avoid labor disputes in the future; but it is only fair to say that Mr. Rockefeller's much-advertised "plan" is almost identical with that previously worked out by the company's local officers. The Colorado Fuel and Iron Co. has always shown ample concern for the welfare of its employees, the trouble being that the plans are not always sympathetically carried out by the mine-bosses and subordinate officials.

In the metal-mining districts the feeling between employers and employed generally is more cordial than for many years past. The new workmen's compensation bill, which provides also for an industrial commission with authority to regulate labor disputes and prescribe safety conditions, went into effect in August, and will, it is hoped, have a salutary effect in perpetuating harmonious relations. The basis of compensation provided by the act is less liberal than that ruling in most states, but the expense is probably all that the industry, in average years, can bear.

Various modifications of the flotation process have been applied during the year in many milling plants, usually for treatment of the slimes, as an adjunct to wet concentration. The process seems likely to prove very beneficial and to be widely adopted in this state, although usually on a small scale. Unless selective flotation methods become perfected, the process is likely always to be subsidiary to the ordinary method of coarse concentration, and to be employed in the main for recovery of the more friable minerals lost by ordinary practice, the combination forming in itself, a rough kind of selective treatment. Of course this would not apply to such cases as the Portland, where only a single product is wanted. On the whole the field for the flotation process in Colorado seems to be extensive and the method bids fair to prove of far greater benefit to the mining industry here than the cyanide process has been, for which result there would be a special fitness, in that flotation appears to have originated in this state.

Outlook of U. S. Smelting, Refining and Mining Co.

The following statement was issued by the United States Smelting, Refining and Mining Co. after its dividend declaration of Dec. 28, 1915, of 1½% on the common stock, after having passed the common dividends since July, 1914:

At the meeting of the board of directors held on Dec. 28, 1915, the regular quarterly dividend at the rate of 7% on the preferred stock was declared, and a dividend of 75c. per share, or at the rate of 6% per annum, was declared on the common stock. Both dividends are payable on Jan. 15, 1916, to stockholders of record on Dec. 31, 1915. In resuming the payment of dividends on the common stock, the directors feel that the stockholders should be placed in possession of the following facts:

At the several quarterly meetings of directors held during the year, it was decided that owing to the unsettled conditions in Mexico, it was wise to take no action on common dividends and to allow the cash resources and working capital to increase. While conditions in Mexico have improved, they are not yet normal, but as earnings from the properties in the United States have been larger than expected, and with the expectation of earnings from Mexico being larger the coming year, the directors decided to pay a dividend on the common stock at this time.

The earnings for the last year (December estimated) will show a surplus of over $4,300,000. This surplus is after payment of preferred dividends and after a reserve for depreciation, improvements and exploration of nearly $800,000 and a special reserve from earnings from zinc smelteries large enough to write off the investment made during the year in them to less than one-third of their cost. Present indications are that the earnings from them during January and February will be such that the remainder of their cost will be earned and can be written off by Mar. 1, 1916.

This surplus after these reserves is equivalent to over $12 per share on the common stock, or to a rate of over 24% per annum. The earnings for the last quarter (December estimated), owing in part to the sale of metals at high prices, will be the best of the year, being at the rate of over 50%, or $25 a share, for the common stock per annum, excluding earnings from the zinc smelteries.

The Mexican properties have contributed about 20% to the earnings for the year. The coal business has been poor and unsatisfactory, but is better at the present time. Coal and railroad properties will fail to earn the fixed charges on the $10,000,000 of Utah notes by about $165,000 for the year. This deficit has been reserved from earnings before arriving at the net earnings.

There have been new and important developments in some of the properties during the year, which have already resulted in putting in sight a new tonnage of ore of high grade and large in quantity. These new developments, while within the old properties, are in entirely new territory.

These developments are continuing, and although it is impossible at this time to estimate their full value, the directors believe the stockholders should be informed that the possibilities appear so large that with a further continuance of these developments it is possible that a new standard of values may be made for the common stock.

Details of Practical Mining

Design for Mine Car and Rolling Side-Dump Tipple

By Roy F. Smith*

Frequently, in order to satisfy local hauling conditions, a special tramcar must be designed. In a recent case a 9-mi. down-grade haul for concentrates and in another a 2-mi. down-grade haul for ore were factors in the problem. It was desirable in both cases that the cars be equipped with brakes and that they be hauled in trains of from four to five cars, that they should have a large capacity and still be light in weight and construction, and that there should be no possible leakage of ore or concentrates while in transit. It was also desirable that the center of gravity of the cars should be low and that there should be some easy method of dumping them at the terminal. To fulfill these requirements the car and rolling tipple shown in the accompanying photographs and sketches were designed.

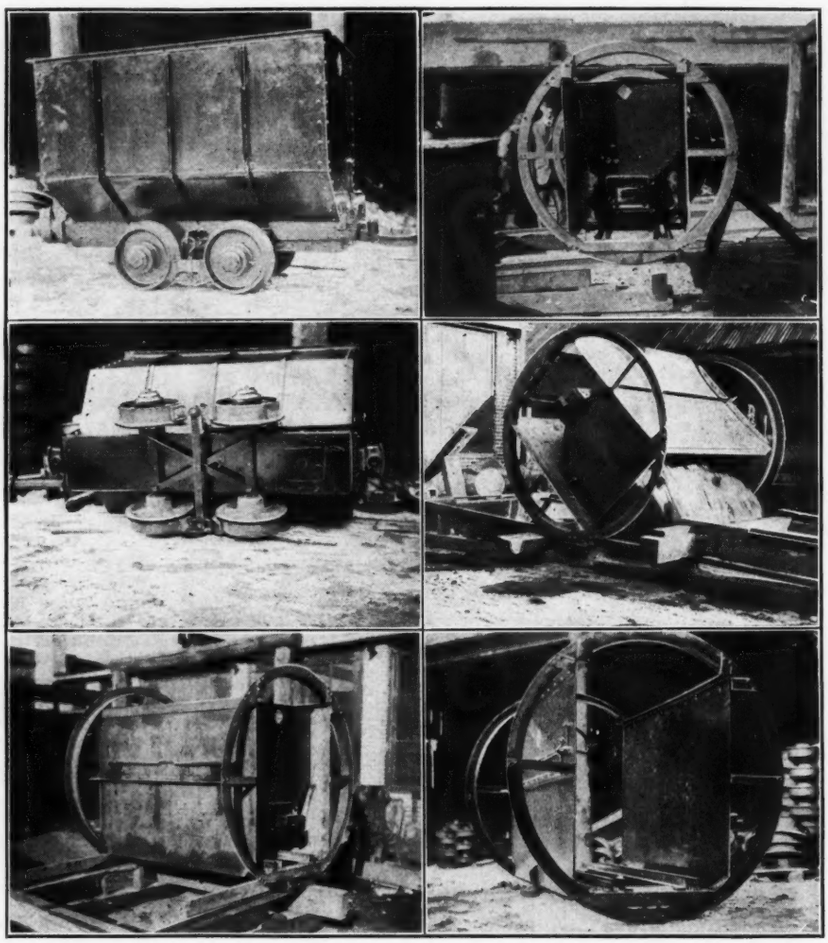
This car is built entirely of metal and is equipped with Truax-Hyatt roller-bearing wheels. It has a capacity of 30 cu.ft. and weighs 730 lb. The center of gravity of the car, when empty, is about 15½ in., and when loaded it is about 23½ in. above the top of the rails. Both the wheel base and gage are 18 in. The body is mounted directly on the axles. The sides are made of No. 12 steel plate and are reinforced by 1x1x⅛ angles. The bottom of the body is made of ¼-in. plate.

The tipple is made up of two 2x3x⅜ angle-iron rings, to which are fastened the rails, plates and angles which inclose the car. The car is held in the tipple by means of two angles that engage the top of the car. The ends of these angles are split and bent back to the rings and riveted to them. A car catch similar to those used on cages is attached to one of the side plates of the tipples, so that the car may be held rigidly while the load is being dumped.

In dumping a car in the rolling tipple, it is pushed in and spotted; the car catch is then pulled down, and the tipple with the loaded car is allowed to roll over. With the car loaded, the center of gravity of the device has been estimated to be about 1½ in. above the center of the ring, and with an empty car, to be about 6½ in. below the center of the ring. The center of gravity of the arrangement thus shifts about 8 in. while dumping and causes the tipple to move practically automatically. When the tipple has returned to the normal position after dumping, the car catch is raised and the empty car is pushed out the opposite end from which it entered. The tipple is then ready to receive another loaded car, and the operation is repeated.

This arrangement was designed to be placed on top of the crude-ore storage bin at a mill or on top of the shipping bins at the railway siding. The track for the tipple is laid at right angles to the mine track and on a 2½% grade. In order to give it a solid foundation for the rolling load, it should be laid on heavy timbers (preferably standard railroad ties) spaced about 24 in. centers. In order to provide abundant space through which to dump the load into the bin, one tie may be omitted at the point where the load falls; that is, about 6 ft. from the normal upright position of the tipple.

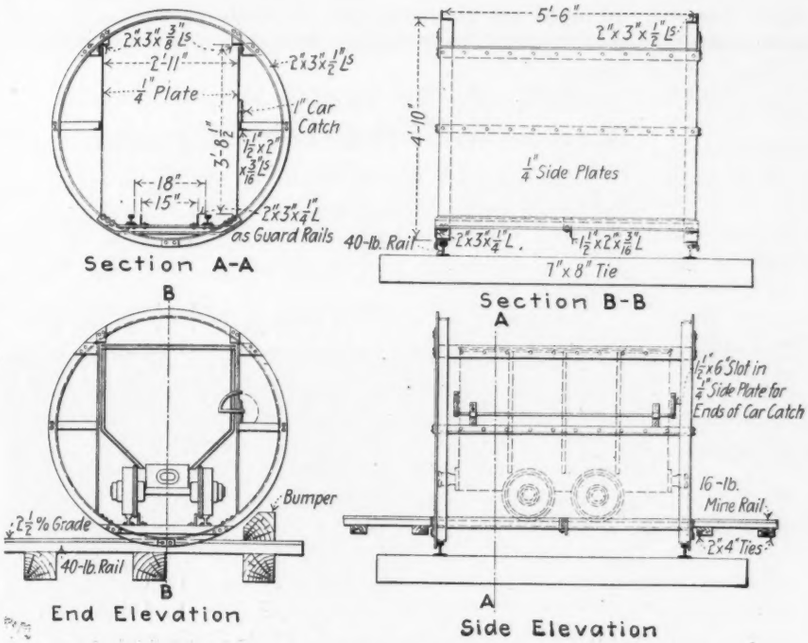
The tram or mine track leading to the tipple should be placed on a level with the car rails in the cylinder. A track should also be laid on the same level on the opposite side of the tipple, to provide trackage for the empty



APPLICATION OF SPECIAL TYPE MINE CAR AND ROLLING-DUMP TIPPLE

*Mining engineer, 1845 Grant St., Denver, Colo.

cars after dumping. A siding connecting the tracks for the loaded and empty cars, and passing around the tipple, would be advisable, provided there is sufficient space. With such a siding, the empty cars may be returned to the mine or tram track without repassing them back through the tipple. Several tests were made with this car and tipple on a temporary track laid on timbers placed about 18 in. above the ground and the car loaded with damp gravel. These experiments show that the scheme is nearly automatic. With a level track, however, the tipple turned only partly over and dumped about 80% of the load. That portion remaining in the bottom of the car, together with the weight of the car, wheels and axles, gave such a low center of gravity as to cause it to return to the normal position and hit the bumper with considerable force. The experiment was then repeated with the tipple track laid on a 5% grade (6 in. fall in 10 ft.). With this arrangement all the load was dumped with the exception of about two shovelfuls and would have been completely dumped had there been sufficient space below the tracks to receive the load. A timber was placed across the tracks in this test, at the point where the load dumped. The flanges of the tipple rings hit this bumper with considerable force, causing the device to return to the normal position and strike the bumper at that end with a jar. In order to obviate these jars and at the same time completely dump the load, it has been decided that it would be best to set the tipple tracks on a grade of 2 or 2½%. The tracks on which the tipple rolls should be from 10 to 12 ft. long; that is, long enough to allow the device to turn upside down when unloading and to extend far enough in the other direction to allow the tipple on the return to go a foot or so beyond the normal upright position. A bumper should be provided at both ends of this track so as to prevent the tipple from leaving the ends of the rails. It has been suggested that, in order to hold the tipple rigid and to make the rails in it match the mine rails after each operation, a notch be cut in the flanges at the top of one or both the rings and an overhead lever be arranged so as to drop into these notches when the tipple is in the normal upright position. Possibly a braking device may be needed to control the speed of the tipple. If so, it has been suggested that two beams be suspended above the cylinder so that these timbers can be brought down against the flanges of the rings, thus acting as a brake. Such a tipple and car can be built to sell f.o.b. Denver at $50 and $60 respectively.

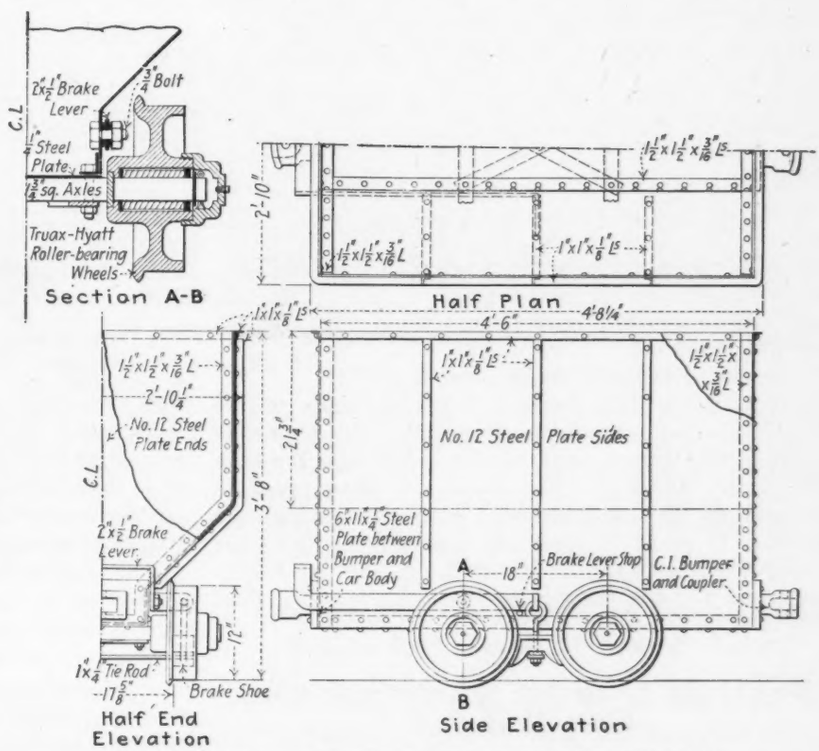


DETAILS OF ROLLING SIDE-DUMP TIPPLE FOR MINE CARS

Some of the advantages of this scheme are:

1. Cars having a solid body can be used, thus permitting of a cheap, light and simple construction, being merely a sheet-iron box mounted directly on the axles.

2. Cars of this type can be built lighter, stronger and lower for a given capacity. A low center of gravity for the car is thus obtained, making it easier to handle and shovel into, easier on the track and less apt to jump on



DETAILS OF MINE CAR FOR USE IN ROLLING TIPPLE

the curves. There is also less dead weight to be transported in proportion to the load.

3. There are no gates required to dump through, making fewer parts to get out of order and hence less repairs. In this type of car (since there are no doors) there are no cracks or crevices through which the ore may sift and no danger of a door or gate being accidentally opened, thereby spilling the load, and consequently there is less expense in keeping the track clean and in repair.

4. A solid-body car can be used for valuable concentrates, as there is no possibility of leakage in transportation.

5. Since there are no doors, the cars may be built stronger and do not need special bracing around such openings.

6. There is less wear and tear on the cars when dumping in a slow-moving rolling tipple than where the "horn" or "cross-over" end-dump tipple is used.

7. A tipple of this size does not require air, steam or electrical power and may be readily operated by one man.

Splitting Logs with Dynamite

Splitting wood with dynamite is easy and cheap and is lots of fun for fellows who like fireworks. It is done in this way: With an auger, bore a hole near the center of the log, going about one-third or one-half through; remove the cartridge paper from the dynamite, crumble the explosive, and with a tablespoon pour one to two spoonfuls of the loose dynamite into the hole. Then after crimping the cap onto the piece of fuse, bury the cap in the dynamite and gently tamp the explosive into the bottom of the hole with a small hard wood stick having a squared end. Then on top of the dynamite tamp in moist clay to the top of the hole, leaving about one inch of the fuse protruding. Light the fuse and retire to a safe distance and watch your timber split into three to five parts. The size of the charge, of course, must be governed by the size of the log. If it is a long log, that is, from 12 to 15 ft. long, one bore hole in the center probably will not split it. It is better to bore one hole in the center and two other holes near the ends.—*Du Pont Magazine.*

Savings Due to Underground Car Loader

At the Morris-Lloyd mine of the Cleveland-Cliffs Iron Co., 4 mi. west of the City of Ishpeming, Mich., a portable car loader underground increased the output 25% within a week after its installation, and later on the increase often reached 30%, according to J. E. Hayden,[1] mining engineer, Cleveland-Cliffs Iron Co. The whole cycle of operation was completed earlier on the 8-hr. shift, giving more time for drilling, consequently deeper cuts were tried, with extra holes to insure breaking.

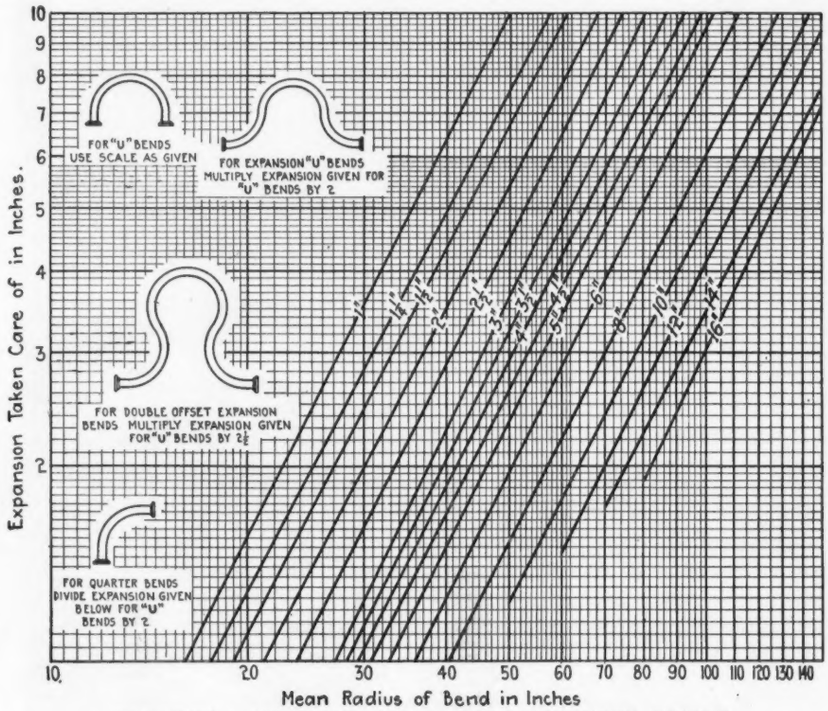
The muckers shoveled into a hopper at the lower end of the belt, the rock being conveyed up the incline and dumped into the motor car, which was of the 3-ton saddleback type. Three muckers shoveled, while one trimmed the car.

[1]In a paper presented before the Lake Superior Mining Institute, September, 1915.

Bends for Pipe-Line Expansion*

In recent years, use of pipe bends in place of expansion joints has become so common that shapes have been standardized. The advantage is that once in place they require no attention, whereas expansion joints are often a source of trouble.

The expansion value of a bend is inversely as the thickness of the wall and directly as the radius, but no exact information has been available as to how much expansion any given bend will take care of without damage to itself or to the adjacent piping. To supply this information the Crane Co., has conducted an extensive series of tests and published results in the form of curves.



EXPANSION ANY BEND WILL ALLOW WITHOUT INJURY

The formula for U-bends is

$$E = \frac{0.0052\ R^2}{d}$$

in which

E = Expansion in inches;
R = Mean radius of bend in inches;
d = Outside diameter of pipe in inches.

If any two of the three values are given, the third can be easily found from the curves. Example: What is the necessary radius for a U-bend to take care of 3 in. of expansion in an 8-in pipe? Referring to the curves and running out horizontally from 3 in. to the line marked 8 in., the radius of the bend is read as 18 in.

*By W. L. Durand in "Power," Dec. 7, 1915.

Details of Milling and Smelting

Manganese Steel at St. John del Rey Mill

It is interesting to note that in the work of rock crushing and regrinding at the St. John del Rey Mill at Morro Velho, Brazil, manganese steel, which gave such admirable results in rock breakers and tube mills, did not compare favorably with the chilled-iron shoes and dies for the stamp mill which were made at Morro Velho. This of course means taking into account the life of each and the cost for putting them in operation.

In testing two types of liners for the tube mills, it was found that the one with the deep channels had a much longer life than the one with the shallow channels. In the mills now being installed, the deep-channel type of liner is being used, and the lining plates will be put in staggered.

Roller bearings have been applied to the tube mills, and although the time of testing has not been sufficient to absolutely determine the saving secured, it appears at this time that the power requirements of each mill have been lessened by about 7 hp. through their use.

Using Old Tube-Mill Liners

The necessity for making the most of every resource has led to the utilization of worn tube-mill liner bars, according to *Financial Times,* London, Dec. 8, 1915. In a paper read before the Chemical, Metallurgical and Mining Society of South Africa, J. M. Dixon noted a number of plans whereby old bars of the Osborn type could be put to service.

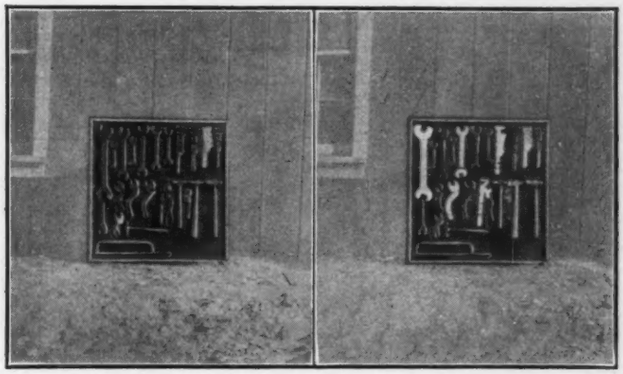
In the coarse crushing plants endless expense is caused by the excessive wear of launders, and relief has been found in employing discarded tube-mill bars for this purpose. The bars are selected to a more or less uniform size and are set in cement, the thickest ends being placed at the lower end of the stream to avoid splash. If insufficient time is available to allow the cement to set, the liner should be completely covered with belting or other suitable material, to afford protection for some days. The wearing faces of battery bins can be covered with worn bars set on end and held in position either by staples or by crosspieces bolted to the bin. Battery feeder chutes, when lined by laying discarded bars cut to suitable lengths side by side and wedging with wood (cement need not be used), give no further trouble.

The use of steel bars for lining bins and chutes is by no means novel, and the foregoing remarks rather indicate a new source of supply. It may be, however, claimed that the use of worn tube-mill liner bars as liners to the stamp-mill mortar-box is new. Trials made of using this waste material to line the backs of mortar boxes have given very good results. A close selection of bars has to be made in order to get a more or less uniform and suitable thickness. The bars when cut to the desired lengths are beveled, the bevel corresponding to that of the end liners, and when placed horizontally in the box are held in position by the end liners, small wedges of hardwood being driven in to complete the lock. Nine to twelve pieces form the back liner, according to type of box, and those receiving most of the wear are easily replaced by pinching up the top pieces and changing only those worn out. The top and bottom sections are available for three or four liners. The metal left in a cast-steel liner is considerably greater than that actually worn away, but the casting nevertheless must be discarded because it does not form a complete protection to the box. These bar liners give quite a good life, and when compared with imported manganese steel a considerable saving is effected, the cost of cutting being practically negligible.

A Convenient Tool Board

By Henry Eggers*

A handy receptacle for tools that has some novel features is in use at the mill of the Wellington Mines Co., Breckenridge, Colo. It consists of a framed board, painted



A TOOL BOARD SHOWING ABSENTEES

black, upon which the usually required tools are hung. Directly under the tool itself is a silhouette of the tool in white paint. When an implement is removed, its absence is apparent at a glance, and it is easy to tell which tool is absent from its place. The board makes for care and orderliness in handling the tools.

Bryant's Method of Shaking Bags by Compressed Air

Albert D. Bryant, of Palmerton, Penn., has invented (U. S. Pat. 1,163,318, assigned to the New Jersey Zinc Co.) a method of shaking fume bags by means of compressed air.

The filtering of fumes from smelting furnaces takes place under sufficient pressure to keep the filter bags distended, and this pressure tends to hold the solid particles against the inside of the bag. Therefore, before attempting to remove the particles, the pressure inside the bag is reduced so that the bags may hang limp. Then compressed

*Denver, Colo.

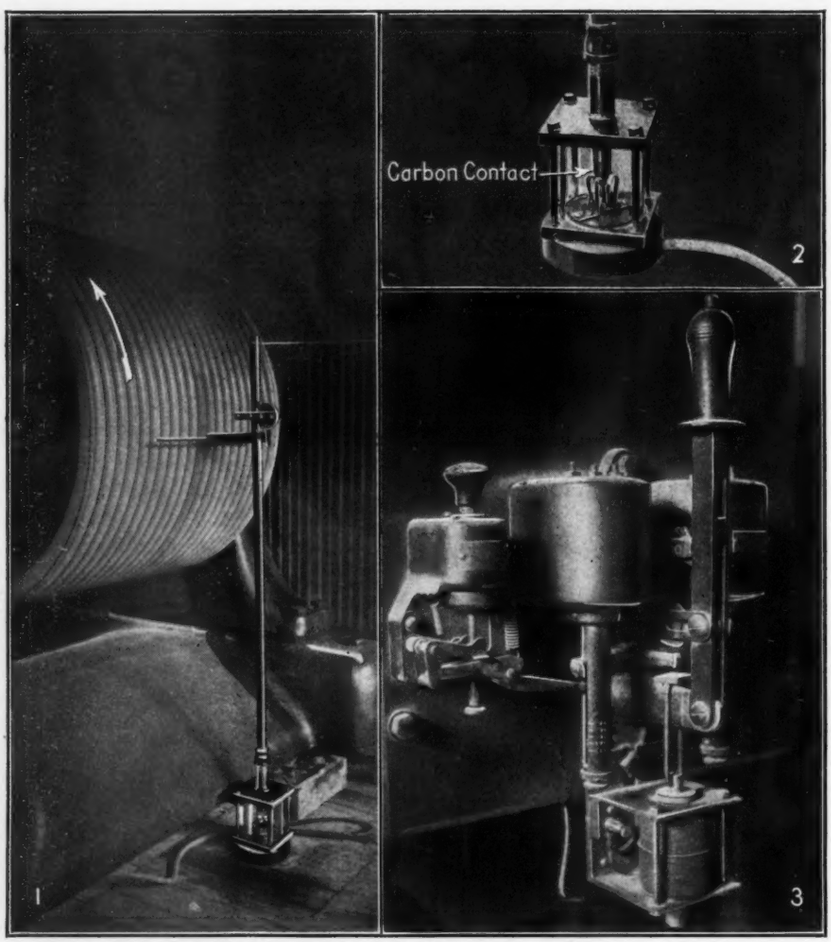
air is admitted through nozzles at right angles to each other, arranged at any convenient point within the bags, so as to cause effective shaking by successive puffs or blasts of air. Means are provided for introducing the compressed air alternately to the various nozzles, thus producing a vibratory movement of the bags.

The invention is not limited to the use of compressed air; any compressed gas would be equally efficient, and it might occasionally be desirable to use a nonoxidizing gas. Longer life for the bags would seem to be an advantage of air shaking over the ordinary mechanical shaking, which acts positively against the material of the bag.

A Failing-Rope Indicator

By R. S. Handy*

This apparatus is known as the "Auto-Trip and Safety Device" and was invented and patented by M. J. Bottinelli, an electrician in the employ of the Bunker Hill & Sullivan Mining and Concentrating Co.



FIGS. 1 TO 3. DETAILS OF ELECTRICAL FAILING-ROPE INDICATOR

Fig. 1—General arrangement of indicator. Fig. 2—Detail of carbon-contact point. Fig. 3—Solenoid attachment for operating oil switch

It consists of a telltale, shown in Fig. 1, set up in position to detect a broken strand in a transmission rope on an electric motor. The bar in proximity to the rope has a pivoted stem which engages a cam on the vertical stand. A cord passes around this cam and suspends the heavy carbon contact in a case at the bottom of the vertical stand, as shown in Fig. 2. The rope is traveling in the direction shown by the arrow, so that if a strand becomes loose it strikes the bar and trips the cam, allowing the carbon contact point to drop into the copper terminals, as shown in Fig. 2. This connection introduces current into the solenoid attachment on the oil switch of the motor, shown in Fig. 3. A tappet is attached to the plunger of the solenoid, and when the current is introduced the plunger (or armature), with the tappet, kicks up sharply and throws out the trip in the oil switch and stops the motor. This is all clearly shown in the illustration. By thus calling attention to the loose strand before it has unraveled far, the strand may be tucked and little time lost; whereas, if the rope did not have immediate attention the strands would unravel and possibly wind up in other equipment in the motor room and do a great deal of damage.

In this connection the apparatus is adaptable to belts or other moving parts and may be applied to steam engines, steam turbines or gasoline engines.

The most important feature of the device is in connection with stopping the motor from some distant point in the plant. In our case the jig floor is a long distance from the motor which drives it and up several flights of stairs, so that in cases of emergency much time would be consumed in getting from the jig floor to the motor room. We have a good system of air-whistle signals, but this would be inadequate in a serious emergency. In using the apparatus in question as a safety device, wires are run from the solenoid to various parts of the mill and small knife-switches put on the circuit in convenient places. In case of an accident on the jig floor, for instance, if a man were wound up on a shaft or a shaft coupling broke, the workmen have these knife-switches within easy reach and can stop the motor by simply throwing one of them in. It can be readily seen that this quick action might be the means of saving life or valuable equipment. Furthermore, when this knife-switch is in it is impossible for the operator in the motor room to start the motor, so that the workmen are protected while repairing the accident. We feel that the device is a valuable protection to life and property in our plant, and it seems to me that some such device would be found valuable in most milling plants. The idea is capable of considerable amplification in various directions and since the cost is low enough to be attractive the safety-first idea embodied is very much worth while.

*Mill superintendent, Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho.

Chlorine Detinning is usually understood to be the triumphant process, so it is interesting to note that the Goldschmidt Detinning Co. is still taking out patents for electrolytic detinning with a caustic-soda electrolyte.

Correspondence and Discussion

Concentration Formulas

The method given by Louis Janin, Jr., in the *Journal* of Nov. 27, is undoubtedly simpler and shorter than that of J. E. Clennell, published in your issue of Oct. 30, but in both of them the several weights of the different products have to be known. By means of a simple algebraic equation the same results may be obtained, the only data necessary being the assay value of heads, concentrates and tailings.

If Clennell's original assumptions be taken to be correct (as I am willing to concede), then, avoiding a formula out of deference to the feelings of Mr. Janin, it

DISTRIBUTION OF WEIGHT AND VALUE

	Weight, per Cent.	Assay, per Ton, Oz.	Per Cent. of Total Gold
Concentrates	12.45	6.53	90.8
Middlings	11.45	0.35	4.5
Tailings	70.10	0.055	4.7

will be obvious that the product of the final weight of concentrates multiplied by their assay value and added to the product of the final weight of tailings multiplied by their assay value will be equal to the product of the original weight of ore multiplied by its assay value.

Taking Clennell's data, the assay value of the original ore was 0.895 oz. per ton.

Now let

The original weight of ore $= 100$

The final weight of concentrates $= x$

The final weight of tailings $= 100 - x$

Then

$$6.53x + 0.055(100 - x) = 100 \times 0.895$$

Therefore

$$x = 12.97$$

DATA ON CONCENTRATION AFTER ELIMINATING MIDDLINGS

	Weight, Per Cent.	Per Cent. of Total Gold
Concentrates	12.97	94.63
Tailings (by difference)	87.03	5.35

Would not this method commend itself to the "efficiency experts" in preference to either of the others?

E. M. HAMILTON.

San Francisco, Calif., Dec. 8, 1915.

Fineness of Ore Crushing for Assaying

The point at issue with E. J. Hall is whether the decomposition $2NaHCO_3 = Na_2CO_3 + H_2CO_3$ "is to all intents and purposes complete before any fusion takes place" in an ore-assay fusion. It is not as to dusting or the decomposition of Na_2CO_3 or the time required for fusion, and some assayers may be able to make a satisfactory fusion with some ores without regard to the decomposition of $NaHCO_3$. The following facts completely negative Hall's assertion as to the practically complete decomposition of $NaHCO_3$ before fusion begins in an ore-assay fusion.

Although bicarbonate of soda in solution loses CO_2 on boiling, this decomposition is slow. In the manufacture of Solvay soda a red heat is required to decompose the bicarbonate in a reasonable time. Watt's Dictionary, I, 796, and others, tell us that a mixture of two molecules of the bicarbonate and one molecule of the monocarbonate may be melted. With a borax cover it is extremely easy to observe the edges of an assay charge in active fusion, while the middle does not show the faintest redness. Soon the liquid part of the charge flows to the center on top and completely incloses a core of the charge still much below red. This is not only true in certain cases, but has been observed many times under varying conditions in several years' practice.

While wet concentrates may not roast before the water is expelled, yet parts of a wet charge may dry out and begin to roast before other parts are dry.

FREDERIC P. DEWEY.

Washington, D. C., Dec. 18, 1915.

The Mexican Mining Law

In the *Journal* of Oct. 16, 1915, the letter from F. Roel shows, in the final paragraph, the underlying thought in defense of the Mexican mining tax as proposed by the Carranza authorities. While on its face favorable to those lacking large capital, and intended to convey that impression, it promotes, in reality, the interests of the powerful corporation.

How much wiser is the law of the United States, requiring work only, or that of Cuba, where mining development is making rapid headway and where there is no tax on mining land! Mexico's tax on mining land is entirely inconsistent with the practical absence of tax on farming land. Let her follow Cuba and be democratic. Let her cease to penalize the prospector. LOUIS LANE.

Sancti-Spiritus, Cuba, Nov. 30, 1915.

Smelting at Panulcillo, Chile

In the *Journal* of Nov. 13, page 789, it is stated that the Central Chili Copper Co. was one of the few mining or smelting establishments in Chile that withstood the general crisis in 1914 and worked without interruption after the outbreak of the European war.

The Société des Mines de Cuivre de Naltagua, the Société des Mines et Fonderies de Chañaral and the Société des Mines de Cuivre de Catemou did not shut down their mines, furnaces or converters. The first two are French, the last is a Franco-Belgian organization.

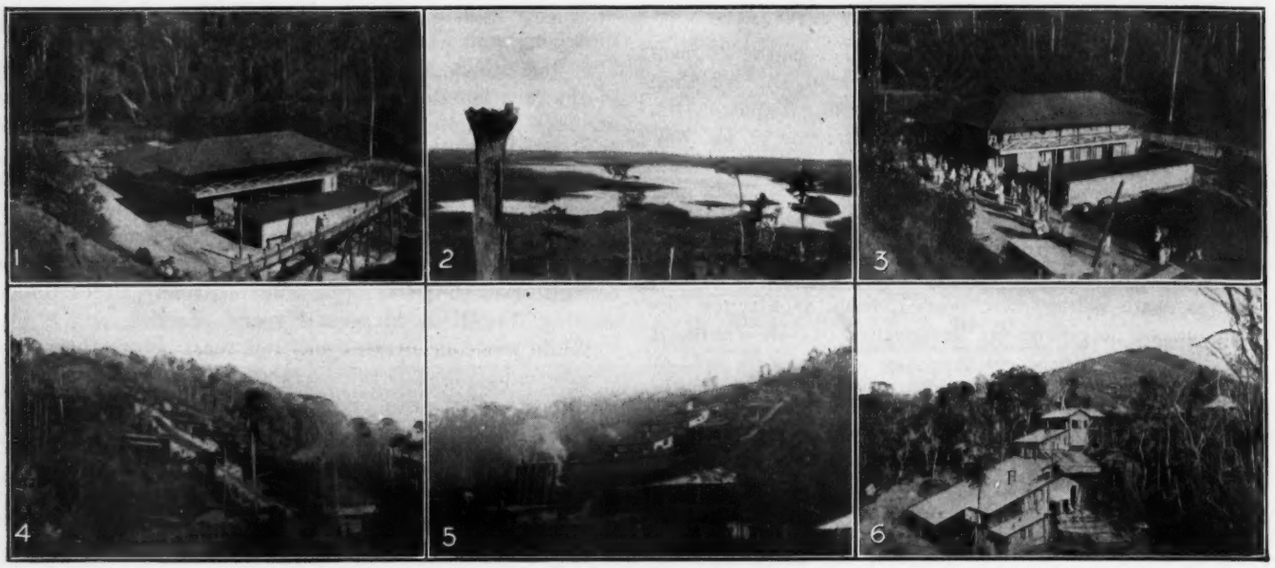
Paris, France, Nov. 29, 1915. MAX LYON.

Always Stronger Detonators

For several years back the *Journal* has been publishing advice to use stronger detonators, and since electric blasting has become popular, to use more than one to a hole. When are we going to carry this matter to its logical conclusion and explode a small cap of dynamite with six large detonator cartridges? ANXIOUS.

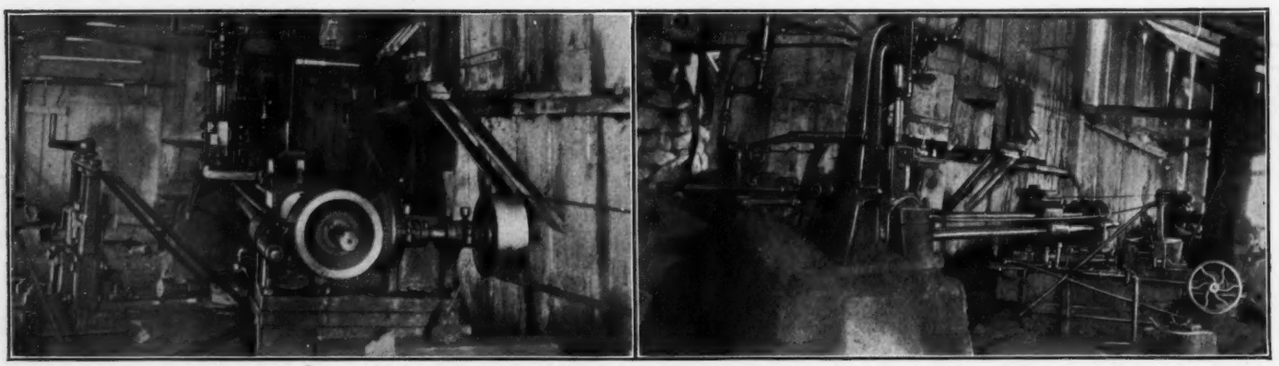
Powderhorn, Colo., Dec. 17, 1915.

Photographs from the Field

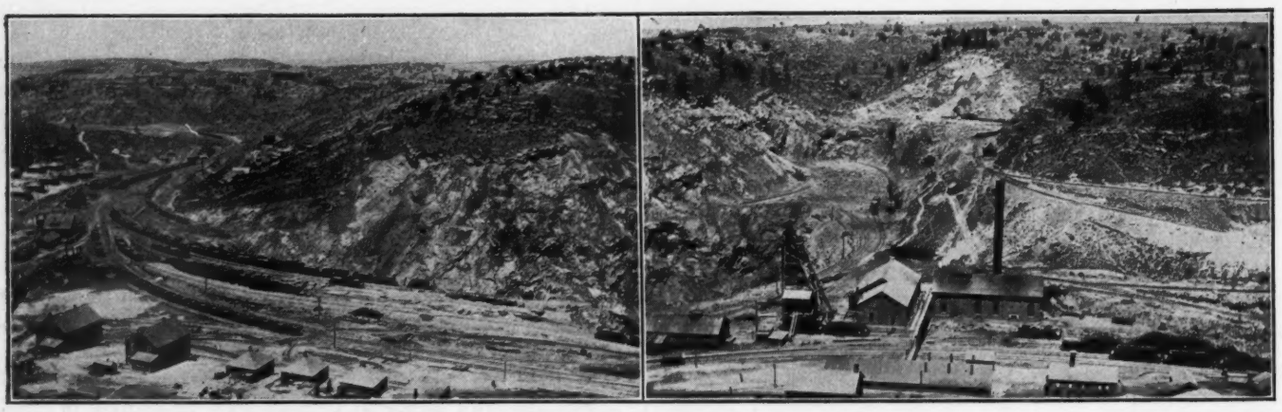


FIGS. 1 TO 6. VIEWS FROM THE AROROY MINING DISTRICT, MASBATE, P. I.

Fig. 1—Colorado Mining Co.'s camp. Fig. 2—Looking west from Mt. Bagadilla, No. 1 level, Colorado Mining Co. Fig. 3—Colorado Mining Co.'s office. Fig. 4—North side, Colorado mill. Fig. 5—South side of mill. Fig. 6—Keystone 50-ton cyanide mill, Aroroy, P. I.

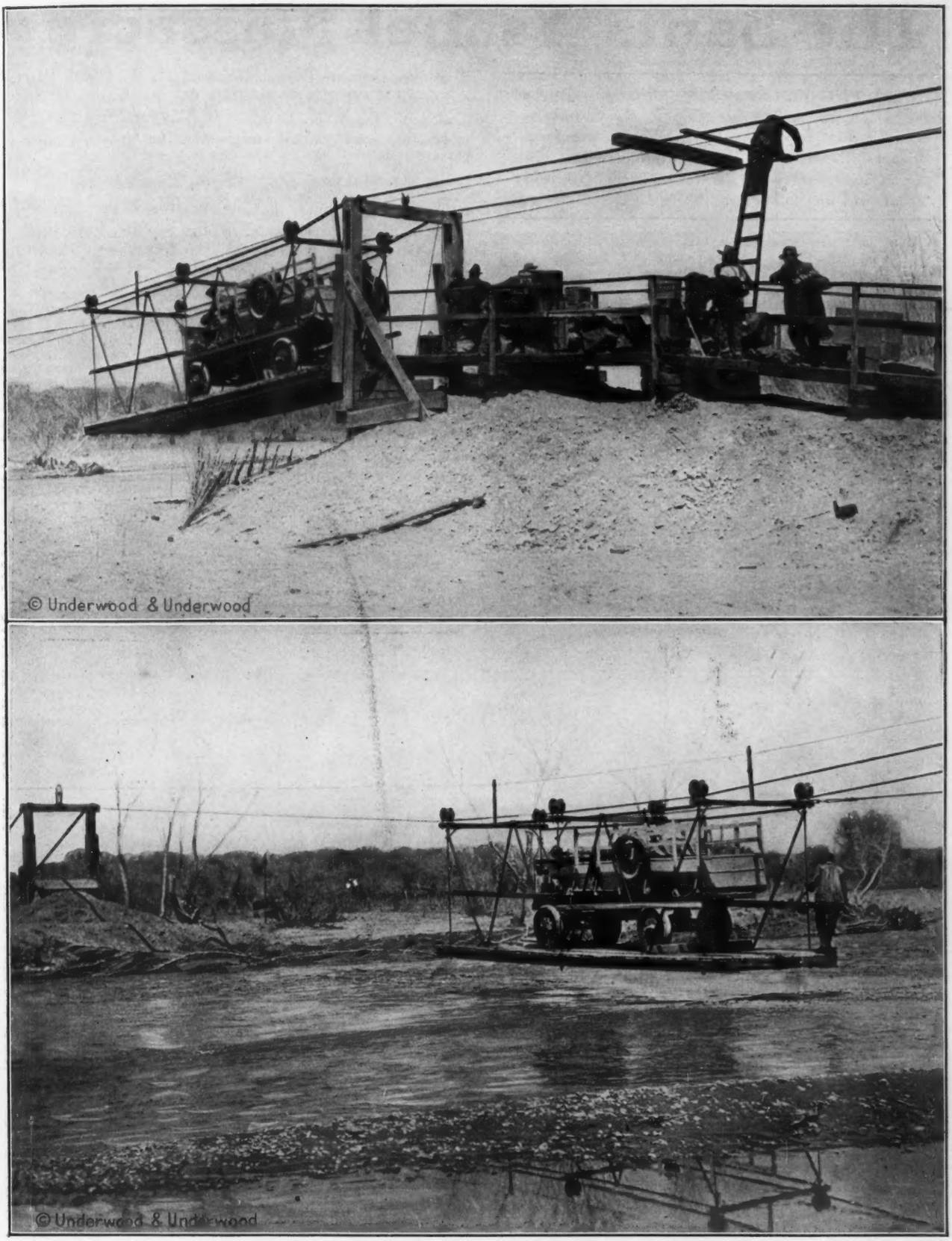


THE ORIGINAL WORD DRILL SHARPENER, AT BLACK OAK SHOP, SOULSBYVILLE, CALIF.



SHAFT, PIT AND PART OF TOWN OF SUNRISE, WYO.

A unit of the Colorado Fuel and Iron Co. Some high-grade copper ore has been found in the lime skirting the hematite. It is shipped to Omaha



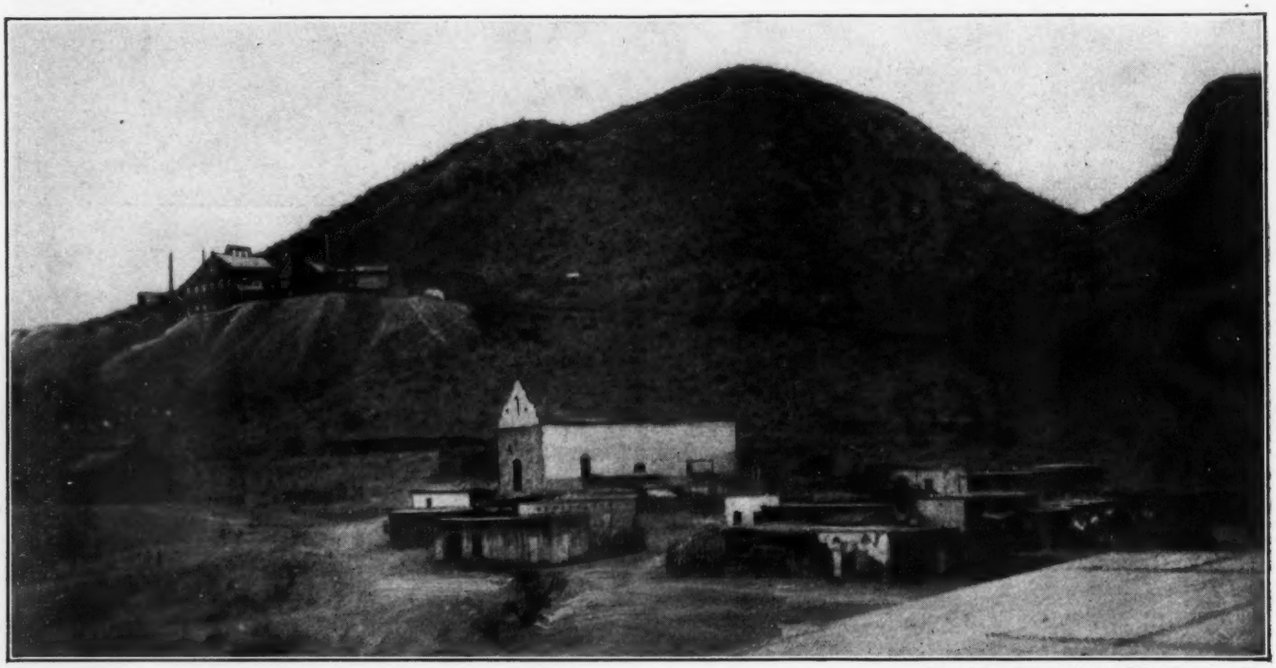
A CABLE FERRY ACROSS THE GILA RIVER IN NEW MEXICO

The amount of transportation between Mogollon and Silver City, N. M., is great enough to require facilities at the point where the Gila River has to be crossed. For this reason the novel cable ferry has been installed, the river being at times too deep for fording. The freight consists chiefly of parcel post, often composed largely of ore destined for railroad shipment at Silver City. The ferry is too light to carry both the truck and its load, so they have to be carried separately. The cables are inclined, permitting gravity crossing with the load, the car being hauled back by a wire cable. Because of increasing traffic, a highway bridge is now in process of construction and will replace this makeshift ferry.

The Santa Ysabel Massacre

SYNOPSIS—Further details of the massacre of the American party proceeding to the Cusihuiriachic mines in Chihuahua, with biographical sketches of some of the mining engineers who, unarmed and unresisting, were murdered in cold blood by Villa followers.

A brief account was given last week of the massacre of the American party bound for the Cusihuiriachic mines in western Chihuahua, Mexico. The train bearing this party, mainly members of the staff of the Cusi Mining Co., left Chihuahua on the morning of Jan. 10. On arriving at Kilometer 68, about 8 km. beyond Santa Ysabel, the train was brought to a stop on account of a wreck ahead. The American party on the train was then attacked by part of a band of about 200 Villistas and massacred. It was one of the most wholesale and cold-blooded murders of Americans in Mexico.



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THE CUSI MINE AT CUSIHUIRIACHIC, CHIHUAHUA, TO WHICH MOST OF THE MURDERED AMERICANS WERE PROCEEDING

The Villista band was supposed to be officered by Gen. José Rodriguez, General Beltran and Col. Pablo Lopez, the last-named being in direct charge of the soldiers who entered the train. There have been rumors of the capture and killing of some of these officers, but these proved premature. The officers and members of the band have been officially declared outlaws and are being pursued by Carranza troops.

The murdered men included 16 native Americans and 2 of foreign birth, though the number and nationality of the dead men have not been finally confirmed at this writing. The list as last reported is as follows: Charles R. Watson, William J. Wallace, Charles A. Pringle, George W. Newman, Herman C. Hase, Maurice Anderson, E. L. Robinson, Thomas M. Evans, M. B. Romero, R. P. MacHatton, Thomas Johnson, J. W. Woon, R. H. Simmons, J. P. Coy, Alex Hall, W. D. Pearce, Charles Wadleigh and A. H. Couch. It is noteworthy that not a Mexican native on the train was killed.

Mr. Holmes' Account of the Massacre

Thomas B. Holmes, the sole survivor of the American party on the train attacked by the bandits, gave to the State Department on Jan. 12, the following statement, which differs from the earlier accounts:

Our train left Chihuahua City Monday morning, Jan. 10 at about 11 o'clock. The train was stopped at or about the Ranch Baeza, a point about 5 mi. west of Santa Ysabel, between 1:30 and 2 o'clock that afternoon. While the train was standing at the station of Santa Ysabel, two armed Mexicans rode by and scrutinized the train. The Mexican passengers at Santa Ysabel told me afterwards that the riders had inquired if there were any soldiers on the train.

At the point of the massacre our train was stopped in a cut so that the last car was just inside of the cut. We were stopped by another train, the front trucks of one of the coal cars of which was seen to be off the track. This was the first we knew of a train preceding us. There was nobody to be seen around the train in front.

When our train was stopped, Newman and I were sitting together, and Evans came up and looked out of our window. Evans, Newman, MacHatton and I then got off the train. Watson was either getting off or about to do so, behind us, when I looked back and saw him.

Just after alighting, I heard a volley of rifle shots from a point on the other side of the cut and just above the train. Looking around, I could see a bunch of about 12 or 15 men standing in a solid line, shoulder to shoulder, shooting directly at us. They were 50 or 75 ft. away. The coach cut off my view, so I could not see how many bandits there were. The depth of the cut, on the side near Santa Ysabel River at that point was about 2 ft. On the other side it was much greater. To the rear of the train was an embankment, declining toward the river.

Watson, after getting off, ran toward the river. MacHatton and I followed. MacHatton fell. I do not know whether he was killed then or tripped. Watson kept running, and they

were still shooting at him when I turned and ran down grade, where I fell in some brush, probably 100 ft. from the rear of the train. I lay there perfectly quiet and looked around and could see the Mexicans shooting in the direction in which Watson was running.

I saw that they were not shooting at me, and thinking they believed me already dead, I took a chance and crawled into some thicker bushes. I crawled through the bushes until I reached the bank of the stream. I then made my way to a point probably 100 yd. from the train. There I lay under the bank for half an hour and heard shots by ones, twos and threes.

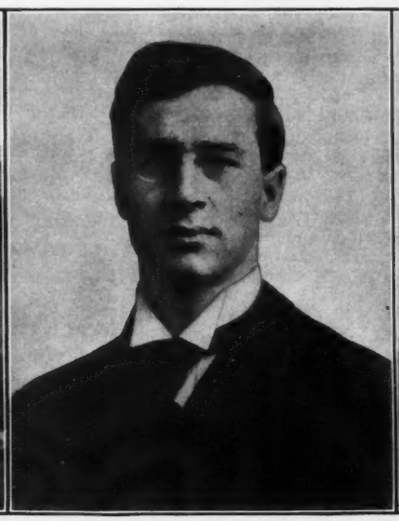
I did not hear any sort of groans or yells or cries from our Americans. Then I continued farther under the bank, wading the stream part of the time, until I reached a point probably 200 yd. from the train. There I remained half or three-quarters of an hour. Later, after going to several ranches and picking my way cautiously for several miles, I met an unknown Mexican, who directed me to Chihuahua City. I reached Chihuahua City Tuesday morning at about 7:30 o'clock. The foregoing facts are of my personal knowledge.

What a Mexican Miner Saw

José Maria Sanchez, a Mexican miner employed by the murdered Americans, was an eye-witness of the massacre and returned to Chihuahua with the train. A New

CHARLES R. WATSON

General manager of the Cusi Mining Co., chairman of the Chihuahua Section of the Mine and Smelter Operators' Protective Association, a member of the American Institute of Mining Engineers and of the Masonic lodge at El Paso



THOMAS B. HOLMES

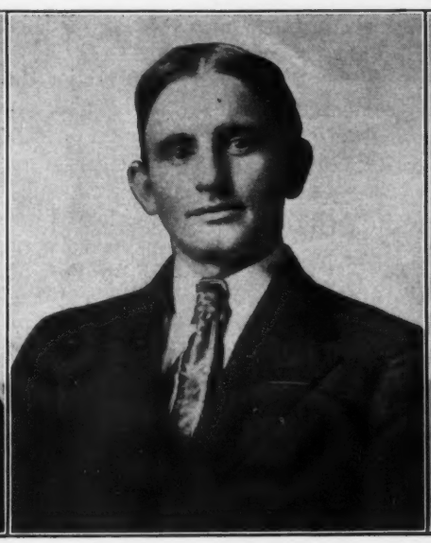
The only surviving American of the Cusihuiriachic party. Holmes escaped by feigning death and reached Chihuahua with the news of the fate of the other members of the party

ALEXANDER H. HALL

Several experienced miners and millmen were proceeding to Cusihuiriachic to assist the Cusi Mining Co.'s engineers in reopening the mines. Alexander Hall was a resident of Douglas, Ariz.

CHARLES A. PRINGLE

A University of California man, famous during his college days as a football star; formerly manager of the Calera Mining Co. in Chihuahua, of the Tintic Mining and Development Co. in Utah; member of the American Institute of Mining Engineers His four brothers in San Francisco have protested directly to President Wilson, asking prompt execution of the murderers and that our Government take immediately the necessary steps to secure the safety of our citizens, and those of other nations, pursuing their legitimate business in Mexico



GEORGE W. NEWMAN

George Willard Newman was born in Keene, N. H., and was a graduate of the engineering school at Dartmouth, class of 1902. He went to Mexico shortly thereafter, being first engaged in railroad work in the southern part of the republic. Later he went to the coal mines in Coahuila, where he was assistant engineer for the Mexican Coal and Coke Co. It is understood that recently he had been connected with Thomas B. Holmes in developing a mine near Cusihuiriachic, but not the property of the Cusi Mining Co., to which most of the party were going

WILLIAM J. WALLACE

Mr. Wallace was a native of Michigan; a graduate of the Michigan College of Mines, class of 1905; member of American Institute of Mining Engineers, of Sigma Rho and of the Masonic fraternity. He was assistant manager of the Cusi Mining Co. and had previously been connected with the Tombstone Consolidated Mines Co. at Tombstone, Ariz., and as superintendent of the Bunker Hill Mines Co. at the same place. He was on the staff of H. L. Hollis, of Chicago, for several years before becoming identified with the Cusi Mining Co.

York *Sun* correspondent reports the following interview corroborating in a general way the Holmes story:

No sooner had the train been brought to a standstill by the wreck the bandits had caused ahead than they began to board the coaches. They swarmed into our car, poked Mausers into our sides, and told us to throw up our hands or they would kill us. Then Col. Pablo Lopez, in charge of the looting in our car, said:

"If you want to see some fun watch us kill these gringoes. Come on, boys!" he shouted to his followers. They ran from our coach crying: "Viva Villa!" and "Death to the gringoes!" I heard a volley of rifle shots and looked out of the window.

Manager Watson was running toward the Santa Ysabel River, a short distance away. Four other Americans were running in other directions, the Villistas shooting at them. Some of the soldiers dropped to their knees for better aim. Watson fell after running about 100 yd. He got up, limping, but went on a short distance farther when he threw up his arms and fell forward, his body rolling down the bank into the river.

Of two others, running for the river, one fell midway. I learned later this was Romero. Four bullets penetrated his body. The other man was hit twice and killed. A young fellow, later identified as MacHatton, got 40 yd. from the train when he was shot.

While this was going on other Villistas crowded into the Americans' coach. I could not see what happened in there, as a frightful panic broke out in our car. Later I learned that the Americans were unarmed.

Pearce was shot as he sat in the coach. I saw Wallace's body on the ground at the car step. He had been shot through the back. Another body was on top of Wallace's. The other Americans were herded to the side of the coach and lined up.

Colonel Lopez selected two of his soldiers as executioners, and this nearly precipitated a fight among the bandits over who should have the privilege of shooting the Americans. Several of the Americans in line had been wounded when the Villistas shot into the coach.

The two executioners used Mauser rifles. One would shoot his victim, and then the other soldier would take the next in line. Colonel Lopez ordered the "tiro de gracia" given to those who were still alive, and the soldiers placed the ends of their rifles at their victims' heads and fired, putting the wounded out of misery.

When the train bearing the bodies of the murdered Americans arrived in El Paso from Chihuahua on Jan. 13, there was much indignation and it nearly reached the point of rioting against certain Villista agents and Mexican residents in general. The El Paso police and the provost guard were unable to cope with the situation, and General Funston finally sent two companies of infantry, but by this time the situation had been brought under control without any serious casualty.

United States Demands Prompt Action

The United States Government has asked Carranza to take immediate steps toward the pursuit and punishment of the murderers. The text of the note to Carranza, sent on Jan. 12 through United States Consul Silliman at Queretaro, follows:

Consul John R. Silliman:

On Jan. 10, C. R. Watson, chairman of the Mine and Smelter Operators' Association of Chihuahua and general manager of the Cusi Mining Co., with 15 of his associates, all representative Americans, while en route from Chihuahua to their mines at Cusihuiriachic, were taken off the train 40 mi. west of Chihuahua City by bandits operating under the direction of General Villa, and deliberately shot and killed. Their bodies are being brought to El Paso.

It is stated these men were murdered because they were Americans and were killed in accordance with the general policy publicly announced recently by Villa. This atrocious act occurred within a few miles of Chihuahua City, in territory announced to be in control of the Carranza forces.

The Villa bands roaming about in western Chihuahua publicly threaten all Americans with death and destruction of their property. Following the occupation of Chihuahua by Obregon's forces many Americans returned to Chihuahua to resume operations with the consent of the military authorities of the de facto government.

Urgently bring the foregoing to the attention of General Carranza, and request that he order immediate efficient pursuit, capture and punishment of the perpetrators of the dastardly crime above mentioned; also strongly urge the immediate dispatch of adequate forces to the various mining camps in the State of Chihuahua.

Request to be informed of action taken. LANSING.

The Carranza government, through Ambassador Designate E. Arredondo, has sent the following promise for the punishment of the Villista band:

I have the honor to acknowledge the receipt of your Excellency's note of this date with its inclosure relative to the murder by Villa forces of 16 American gentlemen near the city of Chihuahua and of the situation in the State of Durango.

Your Excellency may feel asured that my government and myself deeply deplore the dastardly action of the Villa forces and that efficient action will be taken to bring the murderers to justice, and that my government will also take the necessary steps to remedy the situation in the State of Durango. . . .

Renewing to your Excellency the assurance of my profound regret for the occurrence.

General Carranza, in a telegram to his ambassador designate at Washington, states that Constitutionalist government troops have been "ordered to establish strong patrols from end to end of the railway line to forfend against similar outrages" and it has been suggested that trains and guards be at once provided to remove Americans from dangerous districts. Various other outrages have been reported since the Santa Ysabel massacre, but so far no confirmation of these reports has been received. It is expected that for the present most Americans will leave the outlying districts of Chihuahua and either quit the country or stay in some of the garrisoned towns.

It may be recalled that when Carranza was formally recognized last October, he gave the following assurances for the protection of foreigners in Mexico:

The Constitutionalist government shall afford to foreigners residing in Mexico all the guarantees to which they are entitled according to our laws and shall amply protect their lives, their freedom and the enjoyment of their rights of property, allowing them indemnities for the damages which the revolution may have caused to them in so far as such indemnities may be just and which are to be determined by a procedure to be established later. The government shall also assume the responsibility of legitimate financial obligation.

Following the outbreak of civil war in Mexico, many mining and smelting companies found it impossible to carry on operations steadily and safely. In March, 1915, a number of the mining and metallurgical engineers of these companies formed at El Paso the Mine and Smelter Operators' Protective Association for mutual welfare and for the collection of reliable information respecting the state of the country. Charles R. Watson was chairman of the Chihuahua section and after the recognition of Carranza made an investigation of the situation in Chihuahua. Early in January he was at Chihuahua City to ascertain if it was safe to open the mines in the vicity of Cusihuiriachic. According to press reports, the Carranza officials ordered a garrison to Cusihuiriachic and passports were issued to the members of his party.

Charles R. Watson

Charles R. Watson, who was at the head of the Cusi Mining Co.'s staff, murdered en route to the mine in Chihuahua, Mexico, was born in Hartford, Kan., in 1873. He was graduated from the Southern Kansas Academy in 1890 and spent the next eight years as an apprentice and machinist in the Santa Fe railroad shops at Nickerson, Kan. In 1898 he went to Minas Prietas as master mechanic for the Grand Central Mining Co., and later for the Creston-Colorada Mining Co. and for the Butters properties in the same district.

From this time on, most of his time was spent in Mexico mining enterprises. He was master mechanic at La Dura, Sonora, in 1900, and later became mine superintendent. In 1902 he was in charge of the erection of a concentrator at La Bufa, Sonora, and subsequently became manager of La Gloria Mining Co. at La Bufa. From 1905 to 1908 he was engaged in mining examinations, and in the latter part of 1908 accepted a position with the New Sabinas Co. Ltd., at Sabinas, Coahuila. He became manager of the Edna Mines Co. in 1909. In 1911 he went to the Cusi Mining Co. as superintendent, and during the succeeding year was appointed manager of this company.

He was a man of strong personality and had the entire confidence of the owners of the Cusi mine. He also enjoyed the confidence and esteem of other mining operators, having been selected by them as chairman of the Mine and Smelter Operators Protective Association formed at El Paso for the protection of the property of mining companies in Mexico. Mr. Watson joined the American Institute of Mining Engineers last year. He was married about six weeks before his death, and is survived by a widow and two young sons by a former marriage.

William John Wallace

William John Wallace, assistant manager of the Cusi Mining Co., murdered on Jan. 10, 1916, near Santa Ysabel, Chihuahua, was born at Clarksburg, Mich., in 1883. He attended the Michigan College of Mines at Houghton, where he was graduated with the degree of E. M. in 1905. After a short engagement with the city engineer at Houghton, Mr. Wallace went to the Tombstone Consolidated Mines Co., at Tombstone, Ariz., where he remained for about a year. He then became attached to the staff of H. A. Allen, consulting engineer, Chicago, but three years later returned to Tombstone as superintendent of the Bunker Hill Mines Co.

In 1910 he joined the staff of H. L. Hollis, of Chicago, and was later associated with several properties with which Mr. Hollis was connected; he was superintendent of the Princesa mine at Cusihuiriachic in 1911 and became superintendent of the Cusi Mining Co. at the same place in 1913. He was a member of the American Institute of Mining Engineers and of Sigma Rho, a local engineering society at the Michigan College of Mines, where he had been popular, owing both to his personality and to his activity in various branches of athletics. He was a member of the Masonic fraternity which conducted the funeral at El Paso. Mr. Wallace left a wife and daughter.

Herman Carl Hase

Herman Carl Hase, who was a member of the Cusi Mining Co. party murdered en route to Cusihuiriachic, Mexico, on Jan. 10, 1916, was born in Dresden, Germany, in 1881. He came to this country when a young boy, graduated from the public school in Kansas City in 1896, and in 1900, from the Manual Training High School at Kansas City. He attended the Missouri School of Mines, at Rolla, graduating in 1908 with a B.S. degree.

During 1906-07 he was on the engineer corps of the Cananea Consolidated Copper Co. at Cananea, Sonora, Mexico. After leaving college, he worked for the Detroit Copper Co. at Morenci, Ariz.; then for the Tomboy Gold Mines Co., Ltd., at Telluride, Colo.; in 1911, he returned to Arizona and worked in the concentration of the Old Dominion company at Globe. In 1914 he joined the staff of the Inspiration Consolidated Copper Co., for which he did engineering and flotation work in connection with the new concentrator. He was a member of the American Institute of Mining Engineers, having joined in 1914. He was a Mason and the funeral was held under the auspices of his lodge at Kansas City, Mo. He is survived by a sister and a brother.

Charles Alston Pringle

Charles Alston Pringle, who lost his life with 17 other Americans at Santa Ysabel, Chihuahua, on Jan. 10, 1916, was born in Oakland, Calif., 36 years ago. He was educated at the University of California, where he was a prominent figure during his undergraduate days. He was active in athletics and a great football player, having captained his team in 1900.

After leaving the University of California, he was engaged in mining work for several years in Mariposa and Nevada Counties, California, and at Victor, Colo. He was manager for several of the Schley mining properties, having been in charge of the Calera Mining Co., at Calera, Chihuahua, for about four years and manager of the Tintic Mining and Development Co. in Utah for one year. He had returned to Mexico several years ago, but had been compelled to leave when the revolutionary disturbances again became active in the northern section of the country. It is assumed that Mr. Pringle, like several others of the unfortunate party, was not proceeding to the property of the Cusi Mining Co.

Mr. Pringle's family was from Charleston, S. C., and moved to California about 40 years ago. His mother, Mrs. E. J. Pringle, four brothers and one sister, survive him in San Francisco, and another married sister is living in New York. He was a nephew of the late Donald Mitchell (Ik Marvel) and a member of Chi Phi fraternity and of the American Institute of Mining Engineers.

William D. Pearce

William D. Pearce, one of the victims of the American massacre in Chihuahua on Jan. 10, 1916, was born in Tennessee in 1865. He went to California early in life, but for the last 15 years had spent most of his time in Chihuahua and was connected with a number of mines, having been an independent operator. He was a member of the Foreign Club and was well known to most engineers who have made their headquarters in Chihuahua during the last decade. He had lately been interested in the Cusi Consolidated Mining Co., the Cusi Minerva company, and mines in Sonora and Sinaloa. His remains were sent to Los Angeles, where he is survived by a widow and daughter and a brother.

George W. Newman

George W. Newman, another of the Americans killed at Santa Ysabel on Jan. 10, was born at Keene, N. H., on May 31, 1879. After attending the local high school, he went to Dartmouth, where he graduated from the engineering school in 1902. Shortly after finishing college, he went to Mexico on railroad work in the southern part of the republic, then to the coal mines in Coahuila, where he was assistant engineer for the Mexican Coal and Coke Co. at Las Esperanzas and later at Lampacitos. He was a native of the same town as Thomas B. Holmes, the sole surviving American of the party. Having been boyhood

companions, it is assumed that they were connected with the same mine near Cusihuiriachic.

The friends of Murray F. Crossette will rejoice that the report of his death proved unfounded, Mr. Crossette not having reëntered Mexico.

The Clifton-Morenci Strike

As 1915 drew toward a close, the mining companies of the Clifton-Morenci district were considerably exercised respecting the performance of the assessment work on their unpatented claims. Their loyal employees were isolated at Duncan, the concentration camp. The strikers were in possession of the field at Clifton-Morenci and threatened to beat up anybody who was sent in. The companies appeared to be unable to send in men to do their assessment work, yet if it were not done they might lose their claims. It was feared that the courts might refuse to grant a protective injunction, owing to the modern theory that the threat of somebody to burn your house does not entitle you to protection, but you must wait until he has burned it.

The companies attempted to have the assessment work done by local men and by employees brought in from the Duncan colony. The strikers refused to permit it. The companies then appealed to the Federal court and an injunction was granted. The United States marshal threw in something over 50 deputies to protect the companies' workmen, and the work was then done without interference. The proceedings leading to this, as reported by the Tucson *Citizen*, of Dec. 24, 1915, are illuminating, of the state of liberty existing in a portion of the United States at the end of 1915. This report, but slightly condensed, is as follows:

That the application of the Detroit Copper Mining Co. to the Federal court at Tucson for an injunction to prevent strikers in the Clifton district from interfering with the company in the performance of assessment work on 132 claims was merely a covert to bring into the district 1,500 former employees encamped at Duncan for the purpose of breaking the strike was the contention of L. Kearney, the Clifton attorney who filed an answer for the defendants and appeared at the hearing of the application held before Judge Sawtelle here today. E. E. Ellinwood and John Mason Ross, of Bisbee, denied on behalf of the company that the application was a covert for bringing strike-breakers into the district, but contended that were such the case they would have a perfect right to do so provided they were being prevented from operating their property.

Organizer Powell, of the Western Federation of Miners, and Sheriff J. C. Cash, of Clifton, Greenlee County, were present at the hearing.

The defendants filed a specific denial of the charges in the complaint and a demurrer. Arguing on the demurrer, Mr. Kearney contended that the plaintiff could not lose title to the mining claims if they were prevented by force from doing the assessment work, and that the company could not appeal to the court until such overt act of violence had been committed, and that in case they were actually prevented from doing the assessment work they could sustain their title to the claims through an appeal to the courts against adverse claimants.

The plaintiff cited cases to show that the courts do not wait until force meets force and damage is done, but where showing is made of anticipated trouble the courts grant the relief prayed for. Its lawyers argued that when the defendants claimed no adverse right, they could not defeat the injunction by merely filing a denial of the allegations of the complaint under oath.

Mr. Kearney, representing the defendants, asked to introduce oral testimony to show that the application for the injunction should not be granted. His first witness was Sheriff J. G. Cash of Greenlee County.

Sheriff Cash testified that responsible contractors in Greenlee County could be found to take the contract to do the assessment work on the claims. On being asked by the court to state the names of some persons who would take such a contract, he said that he could not specify names.

"Do you think that responsible men in the district would take the contract and would be permitted to do the work regardless of whether they employed men in the district or brought in men?" he was asked by the court.

"It would depend on whether they paid them the wage scale formerly paid by the company or the wages demanded by the strikers," he replied.

Sheriff Cash was asked why he advised Mr. McLean, of the company, that to bring in men to do the assessment work would result in violence.

"The issue between McLean and the strikers over whether the latter shall be permitted to do the work arose from the fact that the company proposed to pay the men the old scale and the strikers wanted them paid higher wages," he said.

The court asked Sheriff Cash whether he could protect men brought in from the outside to do the assessment work.

"I could probably not protect them with my present force of deputies," he replied.

Attorneys for the companies attempted to show that the sheriff was partial to the strikers. A pass issued by one of his deputies asking strikers not to molest the bearer who would leave in 24 hours was shown him. He said that this was the only such pass issued that he knew of. He admitted that he had refused to appoint 25 "neutral" deputies to be paid by the companies, saying that the board of supervisors advised him not to do so.

Sheriff Cash was asked if any of the defendants had objected to the company doing the assessment work. "I do not know," he replied. "I am sure that there will be violence if men from Duncan and the strikers get together," he added. "There will be violence if the men from Duncan are brought in," he replied in answer to a question by the court.

"Isn't it a fact that there are troops there to protect the companies from any violence?" Mr. Kearney asked. "There are about 60 members of the militia there now," the sheriff replied.

"And the captain of the militia is now busily engaged in drilling the strikers?" asked Mr. Ellinwood.

"He is," was the sheriff's reply.

"Isn't he drilling the strikers for the purpose of resisting any attempt to bring men into the district to do this assessment work?" asked Mr. Ellinwood.

"No," said the sheriff. "He is merely doing it as a pastime."

"The strikers are not drilling with guns, are they?" asked Mr. Kearney.

"No, they are drilling on the old dump," said the sheriff.

G. A. Franz, a Clifton merchant and deputy sheriff under Cash, was placed on the stand by the defendants after the noon recess. He said he would take a contract for the Detroit Copper Co. at this time and said he had offered to do so, but he was leaving for St. Louis on the following day and would not want to agree to superintend it and that Dell M. Potter had offered to take the contract for doing the Arizona Copper Co.'s claims at $115 per claim and that he had offered to do the work on 23 claims for this company at $150 a claim and donate $50 on each claim to buy food for the strikers.

Franz testified that it would be like waving a red flag in a bull's face to bring in men from Duncan to do the assessment work and that the companies had agreed with the sheriff's office not to bring in strike-breakers.

Franz said he recalled that at least three strikers had been arrested for disorderly conduct. He testified that the Western Federation of Miners had not ordered any men deported from the district and that none were taken out by the sheriff on its orders. He claimed that the hundred deputies selected by the sheriff were not chosen because of their sympathy with the strikers. He said that only five men were taken to the jail for their protection. He testified that the company could not go in there and do the work at the old wage scale, but in his view if the company paid $10 a day to men on assessment work, it would only have to do $100 worth, or 10 days' work.

This testimony contains several interesting, even alarming suggestions that offer food for thought. Not the least interesting is the one contained in the the last paragraph. Theoretically the Federal Government has an interest in unpatented claims. They are held by private persons and corporations on the condition that $100 of work be done annually per claim. The idea that this condition might be fulfilled by doing $100 worth of work at $10 per day looks like a proposal to cheat Uncle Sam.

Editorials

The Murder of the Cusi Men

The infamous murder of 17 Americans in Chihuahua, Jan. 10, shocked not only the mining industry, but also the whole country. A party of mining men was returning to reopen the mines at Cusihuiriachic, believing that the internecine strife in Mexico had ended and that it was possible to go to work in Mexico once more—these men doing simply what many others were doing in other parts of Mexico. Their train was held up by a remnant of Villa's men, and they were ruthlessly shot with horrible circumstances, but one man escaping. Persons engaged in the mining industry—many of whom have lived in Mexico—know that such things are not extraordinary there, but even the old hands were dazed by the wholesaleness of this slaughter. Moreover, several of the murdered men—Watson, Pearce, Pringle and others—were prominent in the mining industry, were widely known, and there are therefore thousands of persons in this country to whom this outrage is directly brought home.

On the American public generally the effect is to draw attention to the situation in Mexico as never yet it has been. Among mining men the policy of the administration toward Mexico has been generally condemned. The unwillingness of the highest officials in Washington to listen to advice of experienced men—men of the highest standing—has been regarded as an attitude of evil foreboding. But among the more conservative the weakness of the administration has found the excuse that it felt that it had no general public backing. There was a strong popular feeling with regard to Mexico only along the border. To a less extent there was interest in California, Nevada, Utah and Colorado, states wherein the people have more or less to do with Mexico. But in the Middle West, in the cotton states, in New York and New England, people—barring handfuls of them—neither knew nor cared about Mexico. However, the Tampico and Vera Cruz episodes excited the popular imagination—not very strongly but nevertheless sufficiently—and then was the time when something effective could have been done, indeed was started. When no real advantage was taken of the frame of mind then developed in the United States, the excuse of the apologists fell down. It remained for the horror of last week to arouse public sentiment, and as "Remember the Alamo!" was the formula in 1836, and, "Remember the Maine!" in 1898, so will be "Remember the Cusi men!" in 1916.

Now, with regard to what should be done in the immediate emergency, the administration is manifestly doing all that can be expected of it. A responsible government in Mexico had previously been recognized. A party of Americans was murdered by outlaws. Complaint and demand for punishment were made to the responsible government, which replied that it would do its best. This is quite according to rule. With conditions reversed, the international procedure was just the same when the Chinese were murdered by a mob at Rock Springs, Wyo., and the Italians at New Orleans. But the parallelism goes no further. The Rock Springs and New Orleans outrages were sporadic, accidental. The foreigners were present in those places purely of their own volition. On the contrary, the Americans were officially invited into Mexico to develop the resources of that country. Having done so, having acquired large property interests there, it is idle to say that they ought not to be there. The responsible government of Mexico could not protect the Cusi men and perhaps cannot even punish their murderers. This was not an event of purely sporadic, accidental character. The same thing has been going on all over Mexico, and repetition is apprehended. Why should this be so, why should there be in Mexico no government capable of maintaining order? In the answer to that question lies the culpability of Washington, which during three weary years has been talking fol-de-rol about the rights of the people, the machinations of the interests and the settlement of Mexico's troubles by a free and fair election!

The population of Mexico comprises a relatively small proportion of the descendants of the Spanish conquerors, of unmixed blood, and a larger proportion of Spanish blood with some Indian admixture; but the bulk of the people is Indian, or Indian with only a little Spanish blood. In the north there are the Yaquis, the Tarajumares, the Xiximes and other tribes. Around the capital are the Otomies, the Tlascalans, the Aztecans and the others that figure in the history of the conquest. Most of these Indians speak dialects of Spanish, but there are large districts wherein the native languages still prevail. The *indios* and the *mestizos* are in the main simple, docile folk whose chief thought is to get enough to eat and wear, which they accomplish only by almost slavish work. They are illiterate, untutored and quite incapable of conducting a republican form of government. Mexico has never been a republic in anything but name. A free and fair election? What bosh!

With such conditions, with such a population, it was but natural that a smaller, more intelligent class of people should exploit the larger, less intelligent. Also it was but natural that a class of bold and reckless bad men should prey upon both, just as do the gunmen of New York. Amid such a situation a great man—Porfirio Diaz—had the vision of developing a nation, of creating prosperity for it by the utilization of its great natural resources. His own people being unable to furnish the necessary capital, he invited foreigners, especially Americans, to do so, but he knew that before he could go far with his plans, he must make the country safe, must exterminate the bad men, and he set about doing it.

Now, a common vocation among the bad men of Mexico was highway robbery, usually accompanied by murder, for life was held cheaply in Mexico. The Mexican bandit always reckoned that it was safest to kill his victim first and rob him afterward. According to the mind of Diaz there was no use in anybody exploiting a silver mine if the bullion was going to be stolen on the road to the

express office. Therefore he made the trade of the bandit so dangerous to all that were plying it, including those who aided or abetted it or were accessories before or after a crime, that it was not worth anybody's while to engage in it. His measures were ruthless and bloody, but the blood that was let out was bad blood, and the patient was cured, so that by the later '80s in the centers—and by the middle '90s in the remoter regions—Mexico became a country in which it was possible to live safely.

It is needless now to go into the causes that led to the downfall of Diaz and his régime. With that downfall Mexico quickly reverted to what it was 30 to 40 years ago. The outrage on the Cusi men is simply a culmination of a series of similar outrages that have been going on during the last five years, and they are merely repetitions of the murders that used to be done by ones and twos previous to the early '90s. The remnants of Villa's army are marauding and murdering under the guise of revolutionists. The more eminent bandits of 30 and 40 years ago also called themselves revolutionists. A free and fair election in Mexico! There was never a free and fair election in Mexico except with rifles.

Mr. Wilson may watch and wait (for what no one knows), Mr. Bryan may theorize, platitudinize and sermonize, but everybody who knows Mexico is saturated with the conviction that perfect order will not be restored there until the work of Diaz is done over again, nor until the new generation of bandits is exterminated. They must be chased to their lairs just as our cavalry ran down the Apaches during the '70s and '80s. The government of the United States has paid no attention to the legitimate interests of American citizens in Mexico; has refused to understand Mexican conditions or listen to those who could inform it; has declined to participate in Mexican affairs to the end of producing a strong government in that country, which it might rightfully have done; and after watchfully waiting for the phantasm of a free and fair election, witnesses in the murder of the Cusi men the logical result of its supineness.

Revision of the Mining Law

Senator Smoot's bill for a commission to take steps toward a revision of the mining law of the United States was passed by the Senate, Jan. 12. A similar bill is having rather a hard time, however, in the Committee on Mines and Mining of the House of Representatives. Some members of that committee object to spending any money on such a thing as designing good legislation, while Mr. Wickersham, the member from Alaska, opposes the demand for mining-law revision on the ground that the only parties that want it are the Anaconda Copper Mining Co., the Guggenheims and what he is pleased to characterize as the "Broadway interests" in general.

It would follow from Mr. Wickersham's charge that the Mining and Metallurgical Society of America, the American Institute of Mining Engineers, the American Mining Congress, the Idaho State Mining Association, numerous other state and local mining organizations, the United States Bureau of Mines, the United States Geological Survey, the mining press of the United States, Senator Smoot, Senator Thomas, Senator Walsh, and the Senate Committee of Mines and Mining, also the majority of a commission appointed by President Roosevelt (to mention only a few of those engaged in the mining industry who want a revision of the mining laws) are inspired by the Anaconda Copper Mining Co., the Guggenheims and the "Broadway interests." But why those niggers of the woodpile should be going to so much trouble to abolish that miserable old law of the apex deponent saith not.

Forthcoming Spelter Supply

Our statistics of spelter production in the United States in 1915, published a fortnight ago, showed a total of 492,495 tons, the largest on record. This, be it understood, was the output of only those smelters that we class as "ore smelters." There is a considerable additional production by dross and scrap smelters. Certain of these now come within our classification of "ore smelters," and their output in 1915 ought to have been included in the primary total, but we did not consider it advisable to make any change at that time that would interfere with a strict comparison with the figures for 1914. In reporting our revised statistics, however, we shall make the change, and it will then appear that the output of primary spelter in the United States in 1915 was upward of 500,000 tons.

Reverting now to the statistics already published, there are three very remarkable features. The first is the enormous total. Next is the rapid gain in production, quarter by quarter. In the last quarter of 1914 the production was about 93,000 tons. The production of the first quarter of 1915 advanced by about 5,000 tons; the second quarter by about 20,000 tons, this being the quarter when the old idle works were restored to operation; the third quarter by about 12,000 tons; and the fourth quarter by about 14,000 tons. The third noteworthy feature is that the great new plants, including Kusa and Donora, produced but little spelter in 1915. However, at the very end of the year they were just about beginning to strike their gait. Increasing outputs in the first and second quarters of 1916 are therefore to be anticipated.

In fact, at the end of 1915 the listed smelters of the United States possessed a total of about 155,000 retorts, and all of them were reported in use at that time. Reckoning a production of 4.2 tons of spelter per annum per retort, the rate of production at that time was 650,000 tons per annum, or 162,000 tons per quarter. Besides that there were 23,234 retorts reported in process of building, this number corresponding to an output of about 97,500 tons of spelter per annum.

As if this were not enough, there was the Trail production of electrolytic spelter at the rate of about 12,000 tons per annum, scheduled to begin in January, and the Anaconda production at the rate of 35,000 tons per annum, expected to begin late in the summer. The total production in prospect is, therefore, 794,000 tons per annum. There are enough odds and ends in sight, but not enumerated, to justify talking about a total of 800,000 tons per annum.

That enormous total excites thought of a variety of topics that are worthy of deliberate reflection. We do not venture, offhand, to postulate respecting them, but shall merely mention a few of those that occur to us. Whence are coming the men with sufficient skill in the art to operate all of these works? Heretofore there has been a plethora of ore. Will the ore supply in 1916 be

sufficient, however, for our smelters to get along without drawing more freely on Australia, Africa and elsewhere? Has the provision of roasting capacity kept pace with the distilling, affecting the relative demand for calamine and blende? Will the smelting margin shrink before the price for spelter begins to go down? The zinc smelters are going to have many things to think about this year.

Clifton-Morenci Strike Settled

The striking miners of the Clifton-Morenci district voted, Jan. 17, to return to work under the old terms. The only condition made by them was that the mine managers should meet them in conference within two weeks after the resumption of work. To that the mine managers gladly acceded, being willing to meet their employees in conference at any time.

With this consummation a very ugly strike was happily settled. The miners will get high wages under the old scale, owing to the high price of copper, which has advanced sharply since the strike began. No doubt, it was that which determined the striking miners to yield. The mining companies have lost much valuable time during an exceptionally profitable period, but they are to be congratulated upon their sweeping victory over the Western Federation of Miners, which in the Clifton-Morenci district was making its last stand in Arizona.

Governor Hunt and the state officials of Arizona are also to be congratulated upon being relieved from an ambiguous position and the playing of parts that have not redounded to their credit.

Statistics of Copper Production

There is more or less talk about what was shown by the statistics of copper production in 1915, the changes in stocks from beginning to end of the year, etc. A good deal of misapprehension is arising from this, for the statistics are in no wise so complete as supposed and do not warrant the deductions that are being made.

In fact, the statistical reports made so far for 1915 include only a statement of the production of crude copper by the smelters of North America, a statement of the supply of crude copper available to American refiners and a statement (partly estimated and partly based on surmise) of the world's production of copper.

There was no statement of the production by American refiners and none of the stock on hand at refineries either at the beginning or the end of 1915. Anything purporting to be such data is not so, but was guesswork and probably far out of the way.

The world's production of copper in 1915 was given by the *Journal* as about 1,061,000 metric tons. That figure included guesses for Bolivia, Russia, Germany, Africa, Spain and Portugal, and the minor countries, these being credited with a total of 140,000 tons. However, that figure may be 7 or 8% too high or too low without affecting the grand total by more than 1%.

For the present, therefore, the estimate of 1,061,000 metric tons of crude copper produced by smelters in 1915 is near enough. It is about 137,000 tons more than was produced in 1914, about 55,000 tons more than in 1913, and about 41,000 tons more than in 1912. However, the rate of production at the end of 1915 was doubtless much higher than the average for the year, which included three months of curtailed operation.

At the end of 1915 the electrolytic refining capacity of the United States was nominally 1,827,000,000 lb. per annum, excluding the small capacity for refining Lake copper. Estimating an ability to use this to the extent of 95%, the monthly output of electrolytic copper would be about 143,000,000 lb. Reckoning a production of Lake copper of about 23,000,000 lb. per month and of casting about 4,000,000, the total would be about 170,000,000 lb., but that figure is probably a little too high. The highest monthly production of refined copper in the United States previous to 1915 was about 145,000,000 lb.

As for the stock of copper at refineries, the quantity at the end of 1915 was probably less than at the beginning of the year. The behavior of the market during the last month has indicated that it was relatively small—too small to provide the market with the balance wheel that it ought to have.

Contented Copper Miners

Since the beginning of this month announcements of advances in wages have been made by the copper-mining companies of Michigan, Montana and Arizona. Doubtless all the rest of them will follow suit. These advances have been entirely voluntary, carrying out the profit-sharing scheme of making the wage scale proportionate to the price received for copper that was so successfully instituted by the Anaconda company in the first place.

With the big mining companies so much interested in welfare work—schools, hospitals, etc.—and so solicitous that none of their employees hurts himself—not even by his own carelessness—and voluntarily offering them a participation in the profits of the business, we wonder what is the use for Mr. Moyer and the Western Federation of Miners, and how long anybody will continue to contribute to the support of its officers and walking delegates.

BY THE WAY

The safety-first movement steadily gains adherents, according to *Engineering and Contracting*. Patrick was promoted from the ranks to foreman, a position of which he was very proud. He always was fussing around, ordering this and altering that. One morning his gang stopped work because they heard the voice of their new foreman shouting loudly. Down below on the ground stood Pat yelling lustily and waving his arms wildly. "Oi say, you up there!" he shouted. "You know that ladder at the ind of the scaffoldin'? Well, don't any av yes thry to come down, because Oi've taken it away."

At a meeting of the mining and metallurgical section of the Pan-American Scientific Congress at Washington, Dec. 28, Dr. W. F. Hillebrand, of the United States Bureau of Standards, exhibited a specimen of gallium, the first ever produced in the United States. This was obtained from the residue remaining in the retort after the redistillation of common spelter at Bartlesville, Okla. That residue, consisting chiefly of lead, showed a strange exudation and samples being sent to the Bureau of Standards, this was identified as gallium and about 50 grams was extracted and isolated in the elemental form.

PERSONALS

S. F. Shaw is in Monterey, Mexico.

J. B. Tyrrell, mining engineer, of Toronto, Ont., will leave for England about the end of January.

W. L. Clarke, of Jerome, Ariz., manager United Verde Copper Co., recently visited Southern California.

Lawrence Addicks is very ill at his home in Elizabeth, N. J., and is not expected to be able to be at his office again for several weeks.

Dr. John M. Clarke, New York state geologist and director of the State Museum, was elected president of the Geological Society of America at the recent Washington meeting.

Archibald Burton, who has extensive interests in Munro Township, Ont., properties, and is part owner of the claim on which platinum was recently found, has gone to New York.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, and Dr. Willet G. Miller, provincial geologist, have gone to Cuba in connection with the work of the Ontario Nickel Commission.

Howland Bancroft has just returned to Denver from several months absence in South America and leaves within a few days to make his headquarters in Chile during the next two years.

Dr. C. C. O'Hara, president of the South Dakota School of Mines, at Rapid City, has returned from Washington, D. C. He attended the session of the Scientific Congress as the delegate from South Dakota.

J. B. Moore and T. C. McLemore have gone to Mexico to see if conditions warrant opening up of either the Jimulco Mining Co.'s property at Otto, Coahuila, or the Continental Mining Co.'s property at Monclova, Coahuila.

Dr. Charles R. Van Hise, president of the University of Wisconsin and previously professor of geology, has been elected president of the American Association for the Advancement of Science, in succession to Dr. W. W. Campbell.

A. A. Krogdahl, mining engineer of U. S. Bureau of Mines, for the past two years engaged in giving training in mine rescue and first-aid work, in California principally, in conjunction with the mine safety department of the Industrial Accident Commission, has been detailed to duty in the Panama Canal Zone. Mr. and Mrs. Krogdahl left San Francisco for Panama in the first week of January.

T. W. Thompson, of Palo Alto, Calif., started in January for Salvador to superintend a 40-stamp mill at the Devisadero mine. Property is owned by Charles Butters interests of Oakland, who are largely interested in gold mines in South America. Thompson had recently returned from Nicaragua. He stated that demand for engineers in South American mines is becoming more and more insistent.

H. M. Wolflin, for the past two years in charge of the mine safety department of the California Industrial Commission, which is carried on under coöperative agreement with the U. S. Bureau of Mines, has been promoted to the position of mine safety engineer at the Pittsburgh station of the Bureau of Mines. Mr. Wolflin left California on Jan. 10 for Washington and will proceed from there to Pittsburgh.

Edwin Higgins, mining engineer of the U. S. Bureau of Mines, has been appointed to the position of chief of the mine safety department of the California Industrial Accident Commission. Mr. Higgins has for three years given all of his attention to metal mine investigation directed by the Bureau of Mines, with headquarters at Ironwood, Mich. Prior to entering the services of the bureau he was a consulting engineer at Los Angeles. In 1908-09 Mr. Higgins was assistant editor of the "Journal."

OBITUARY

Charles Shields, steel manufacturer of Stockton, Calif., died in that city on Jan. 2 of paralysis following an attack of pneumonia. Mr. Shields went to California from Norfolk, Va., in his youth and had resided in Stockton for more than 40 years.

Captain John Peterson died in Chicago, Jan. 8, aged 43 years. He was born in Michigan and was employed in the copper country for a number of years, rising to be mining captain at the Hancock mine. Three years ago he left the copper country to take charge of the Lincoln iron mine on the Mesabi Range. He was respected for his knowledge of mining and ability to handle men.

Henry Carlin died suddenly on the trail between Jamestown and Sonora, Calif., on Dec. 29. He was 88 years old and had been a resident of Tuolumne County since 1851, when he began mining upon arrival from his birthplace in County Donegal, Ireland. Death was evidently the result of old age, but directly brought on by over-exertion.

Ole Danielson, night foreman for the Homestake Mining Co., at Lead, S. D., died in Seattle, Wash., on Jan. 1. Mr. Danielson was connected with the company for 35 years, going to the Black Hills in 1880. He was born in Norway in 1856 and came to this country when a young man. He left on a vacation several weeks ago, apparently in the best of health and his sudden death was a surprise to his many friends. He was a member of numerous lodges and his funeral will be conducted by the Masonic order.

Archibald D. Carmichael, a well-known British chemist and metallurgist, died Nov. 20, 1915, in Brooklyn, N. Y., of acute indigestion. Mr. Carmichael is best known as one of the inventors and introducers of the Carmichael-Bradford process of ore desulphurization, which was at one time a promising rival of the Huntington-Heberlein process, to which it was similar in certain respects. The Carmichael-Bradford process was introduced in one of the smelteries in Australia. Having completed that work, Mr. Carmichael came to the United States and resided here up to the time of his death, pursuing his profession as chemical and metallurgical engineer.

Thomas Wallace died at his home in New York Jan. 1, aged 88 years. He was born in Manchester, England, and at the age of five came to this country with his parents. In 1839 his father established a wire mill at Annsville, N. Y., and in 1841 removed to Derby, Conn. In 1848, with his brothers and father, Mr. Wallace founded the firm of Wallace & Co., one of the first to make copper wire in this country. He was the first to introduce the continuous wire machinery for drawing fine brass and copper wire, a process which revolutionized the industry. For 15 years past he had been managing director of the Waclark Wire Co. of New York. Mr. Wallace is survived by his wife, four sons and four daughters.

Byran K. Morse was killed by gas explosion on Jan. 12, 1916, at a copper property near Bahia Honda, in the Province of Pinar del Rio, Cuba. The mine, of which Mr. Morse was in charge, was being developed by a company known as El Informador Minero, of San Ignacio 25, Havana, Cuba. Mr. Morse, who was a member of the American Institute of Mining Engineers, was born in Canton, Ohio, Nov. 10, 1877. He had a predilection for mineralogy and went to the Kingman district of Arizona in 1900 as assistant manager of the C. O. D., Golden Gem and Prince George mines, under Henry S. Mackay. In 1903 he did examination work for Henry S. Mackay, D. A. Freeman and S. C. Ferris. Later he was superintendent of the Lead Mountain Smelting and Refining Co. in Arizona and of the Ortega Mining Co. at Cananea, Sonora, Mexico. He went to Cuba a few years ago and had since been engaged in development work at several of the new properties in the western end of the island.

Edward P. Jennings died in Salt Lake City on the last evening of the old year, as the result of a sudden heart attack. Mr. Jennings, who had been following his profession of mining engineering for 18 years in Utah, first made his reputation in the Great Lakes region, where he became identified with the Kimberley iron interests, a connection which continued throughout his life. In Utah he became connected with several of the larger companies, including the Highland Boy and the Utah Apex at Bingham, being at the time of his death consulting engineer for the Utah Metal and Tunnel Co. Mr. Jennings was a man of catholic interests, and his professional knowledge covered a large and comprehensive field. He was born in Becket, Mass., Aug. 24, 1853, and had his college training at Union College, from which he was graduated at the age of 20. A year later he took a position as instructor in chemistry at Cornell University, where he remained until 1879, when he went to the Northwest. Mr. Jennings was a member of many technical and scientific societies, including the American Association for the Advancement of Science, the Metallurgical and Chemical Society, American Institute of Mining Engineers, Canadian Institute of Mining Engineers, etc. He devoted much of his spare time to technical reading, and to petrographical or chemical work. At the time of his death he was a subscriber to 18 different technical publications. Mr. Jennings was of a retiring nature, and was very generous to all that came to him for help of any kind, frequently putting aside his own work that he might help others. He was one of the best informed men regarding chemistry, metallurgy and mining in the intermountain section. He is survived by his widow, a daughter, and a son, who is attending Stanford University.

Editorial Correspondence

SAN FRANCISCO—Jan. 19

(By Telegraph)

Wind Wrecked 500 Derricks and two 10,000-bbl. tanks in the Midway and McKittrick oil fields, Jan. 17. Many buildings were unroofed. Total damage about half a million dollars.

SAN FRANCISCO—Jan. 12

Highgraders are reported operating in the tungsten region about Randsburg and Atolia. It is stated that there are about 40 purchasers of scheelite at Randsburg, some of them women, who buy high-grade float at from $1 to $2.25 per lb. and ship it East where they are reported to receive $2 to $3 per lb. One arrest has been made, but as the ore said to have been stolen passed through a number of hands it is believed that conviction will be difficult; and only conviction and sentence will put the scare into highgraders.

The Statute of Limitations, according to recent decision of the California Supreme Court, does not affect a suit begun in good faith against a corporation, even though many years have elapsed since the commission of the fraud. The court holds that as long as the corporation itself remains under disability and is powerless to act by virtue of the fact that its control is in the hands of a board of directors accused of participation in the frauds against it, the statute of limitations does not run. If one of the stockholders discovers a fraud against it and fails to bring suit the statute of limitations does not begin to run then. And if at any subsequent time another stockholder discovers the fraud and begins suit in good faith, even though many years have elapsed since the commission of the fraud, this stockholder may set the judicial machinery in motion and not be prevented by the statute. The decision was rendered in the Dabney Oil Co. suit. The lower court sustained a demurrer, holding that the statute of limitations had run. The Supreme Court reversed the order. The suit charged that Joseph B. Dabney and other directors conspired to defraud the corporation out of the proceeds from the sale of $76,000 of stock.

Estimate of Mineral Production in California in 1915 by State Mining Bureau places the total value at $95,211,000, being an increase of approximately $2,000,000 over 1914. Several unusual features, more or less attributable primarily to the European war, are described in the report. The two most notable changes are: Increase of zinc production from $20,381 in 1914, to $1,620,000 in 1915; and the decrease of petroleum from more than $47,000,000 to approximately $40,000,000. There are substantial increases in gold, silver, copper, lead, tungsten, manganese, magnesite, antimony and quicksilver. Petroleum yield decreased in 1915 to approximately 90,000,000 bbl. and the average price was about 1½c. per bbl. less than in 1914. A number of wells producing increased to 6,500, but the average yield decreased. The amount of oil in storage was reduced from 58,300,000 bbl. in January to 57,000,000 in December, being the first decline in stocks since 1907. Quicksilver in 1915 was about the same in amount as in 1914, but the value averaged nearly double. Cement, building stone and other structural materials were about the same as in 1914. There were no large building contracts except on the highways. The values of the several substances as estimated by the Bureau are as follows: Gold, $22,850,000; silver, $1,095,000; copper, $7,660,000; zinc, $1,620,000; lead, $295,000; quicksilver, $941,000; other metals (antimony, iron, molybdenum, platinum, tungsten, vanadium), $1,000,000; petroleum, $40,140,000; natural gas, $1,050,000; structural materials, $14,700,000; industrial materials, $1,660,000; salines, $2,200,000.

California Remains the Leading Gold-Producing state. The yield in 1915 is the largest in 32 years and with one exception the largest in 51 years. There are about 700 producing metal mines in the state about evenly divided between placer and lode mines. About 2,500,000 tons of ore was mined and treated, having average value in all metals of $6.75 per ton. Shasta County was the leading producer in total of all metals. Nevada, Amador, Yuba and Sacramento were the leading gold producers in the order named. Nevada and Amador production is chiefly from quartz mines and Yuba and Sacramento chiefly from dredge placers. Placer mines, owing to the importance of the dredging industry are estimated to have produced 44% of the total gold yield of the state; the other 56% coming from the deep mines. The dredges produce 86% of the placer gold. In 1915 there were 67 gold dredges in California; 6 were closed down all or part of the time and one was burned, the remaining 60 were active. Dredge construction was not active in 1915, only one, in Calaveras County, being constructed; one was rebuilt in Natoma field. Three new 16-cu.ft. dredges will be constructed in the Yuba basin district in 1916, one each by Yuba Consolidated Gold Fields, Marysville Gold Dredging Co., Yukon Gold Co.

DENVER—Jan. 13

Molybdenum Deposits are now claimed by Boulder County, one strike having been made in the Mountain Lion lode near Magnolia.

Vindicator Consolidated Mine, according to daily newspapers of Jan. 11, has opened a tremendous treasure vault on the 16th level rivaling, if not exceeding, the famous Cresson vug of a year ago. Inquiry of the company officials, however, elicits a denial of this rumor. There is no attempt to conceal the fact that the mine is in splendid condition with abundant reserves of fine ore. The rumor probably emanated from the stock exchanges in explanation of this stock's strength.

American Smelting and Refining Co.'s operations at Globeville (Denver), Pueblo, Blende, Leadville, Durango and Cokedale—all Colorado plants—give employment to 2,620 workmen in addition to 109 officials and clerks. The Arkansas Valley smeltery and its adjuncts, at Leadville, leads the list with 672 employees. The monthly payroll of the company in the state averages $175,500 for wages and $19,400 for salaries. The company has announced the creation of funds to conduct a social-welfare movement and to increase its insurance for employees.

Snowslides Are Running Already in the higher districts and numerous lives have been lost. One slide ran down Kelso Mountain, 8 mi. west of Silver Plume, catching three men, of whom two were killed outright, one victim being Arthur H. Osborne, mining engineer, of Georgetown. In one slide that ran between Telluride and Ophir, four out of five miners struck were killed. Osborne graduated from the Colorado School of Mines in 1893 and has followed his profession in upper Clear Creek County since that time. Charles E. Harris, motorman at the Camp Bird mine above Ouray, was instantly killed on Jan. 6, when the trestle at the mouth of the mine gave way, precipitating Harris and his trip of cars and catching him under one of the cars. It is believed that it was an indirect result of the running of the Chicago slide that probably damaged the foundations of the trestle, but this cannot be verified because of the heavy covering of snow on the ground.

BUTTE—Jan. 13

Rumors of Consolidation of the following Butte companies—North Butte, East Butte, Davis-Daly, Butte-Alex Scott, Butte-Duluth, Bullwhacker, Butte & London, Butte Main Ranche, Rainbow Development and other small companies having interests in the eastern section of the Butte district—are denied by local officers of these companies, who say that if there is a movement of that kind under way they know nothing about it. That the suggested consolidation would greatly benefit Butte as well as the companies concerned is admitted by all who are familiar with the situation. Whether anything more than a working agreement is to be entered into or whether a deal will involve formation of a holding company that will bring about an actual consolidation, has not been announced. At all events, perfection of such a consolidation will require a multitude of negotiations that will delay its realization for a considerable time.

The Story of Barnes-King Development Co., beginning with its organization in 1906, and leading up to the declaration of a dividend of 7½c. per share on Jan. 11, 1916, and the expectation that the dividend will be paid quarterly indefinitely, makes unusual reading even in the history of the thrills of failure and success of mining adventures. Barnes-King was organized and passed out to the public during the waning days of the greatest mining boom the world has ever known, when everybody was crazy on the subject of mining speculation. There were insane speculators all over the world, but the craziest were in Butte. Somebody saw an opportunity to

land something, and a gold property at Kendall, in Fergus County, Montana, was selected as the bait. When the public had been thoroughly and sufficiently stirred with golden tales, the subscription books were opened. Within two days the entire capitalization of $2,000,000 was over-subscribed in Butte alone. It was stated that the promoters themselves were deceived, but be that as it may, after the first installment of $2.50 per share had been paid by the subscribers, it became known that a lemon instead of a gold mine had been capitalized. When the bubble burst one of the promoters went to Mexico, one to Canada, and one died. A new set of officers were elected, made an exhaustive examination and reported that not more than $50,000 worth of ore was in sight in the property. There were threats of suits, later settled and dropped. The officers tried to develop a mine out of the Barnes-King, but could not. Then finally another change of officers and management and a Butte crowd, including some of the best and most conservative mining men in the country, all of them connected with the Anaconda Copper Mining Co., got hold of the company. They set about to retrieve the fortunes of their friends in this venture. They bought new properties on favorable terms, and they have all been developed into good and producing mines. New properties have gradually been added, and soon after operations were resumed the treasury began to show a monthly net balance, and now, after nine years, the initial dividend has been declared. The company has acquired the North Moccasin mine, adjoining the old Barnes-King, and it has been its consistent producer, profits from it paying for the Piegan-Gloster group and mill in the Marysville district, the Shannon group in the same district, and the Kendall mine and mill and light and power plant, recently purchased. C. W. Goodale, manager of the Boston & Montana mines department of the Anaconda company is president of the Barnes-King, and George T. McGee is manager. C. C. Swinborne, cashier of the Daly Bank and Trust Co., is treasurer, John E. Corrette, one of the attorneys for the Anaconda company, is secretary.

ISHPEMING, MICH.—Jan. 15

Most of the Mining Companies of the Lake Superior iron district have announced that their employees will receive an increase in wages, commencing Feb. 1. When it was announced in New York a few weeks ago that the employees of the United States Steel Corporation would be granted an increase of 10%, it was generally believed that the men working for the Oliver Iron Mining Co., the mining branch of the corporation, would be benefited by the announcement. Such proved to be the case and so the other companies operating in the district agreed to do likewise. A meeting of mine managers of the Marquette and Menominee ranges was held in Ishpeming, at which time the wage question was discussed. It was not stated that the increase would be 10%, but in most cases this will be the amount. Most of the season's output has already been contracted for and it is thought that there may be another advance in prices about the time that navigation opens. There is still some ore to be had, but it looks as though there might be a scarcity, in which case the demand would cause prices to advance again. Some of the operators are not satisfied with the advance of 75c. a ton, claiming that iron-ore prices did not advance in just proportion to the prices of pig iron and steels. However, they are not kicking very hard, but are getting busy to get out large outputs this year. Mines are being opened up on all of the ranges and there were never as many men employed underground during the winter months as this year. This is particularly true of the Minnesota ranges, where there is usually little work done while the cold weather is on. The year's shipments will depend upon the amount of tonnage that the railroads and boats can handle. The Steel Corporation recently closed a contract with the Tomlinson company to carry a large tonnage down the lakes every year for the next five. The corporation has 70 boats of its own.

HOUGHTON, MICH.—Jan. 14

Taxation Difficulties resulting from differences of opinion as to the assessed valuation of the mines of the Copper Range Consolidated are not yet out of the way, notwithstanding the ruling of the state tax commission. The Baltic has paid its taxes in Adams Township under protest. This is conceded to be the first step in litigation relative to these taxes. Under the law 30 days are allowed, following the payment of taxes to protest before beginning suit. The state tax commission, following its hearing in Houghton County raised the assessed valuation of the Baltic $2,300,000 and of the Trimountain $400,000. No protest has, at this time, been made regarding the raise in Trimountain's valuation. The Baltic taxes were $58,767. Presumably this protest will be followed by the filing of a suit. Inasmuch as the protest particularly attacks the state tax commissioners, it likewise is presumed that the attorney general's office at Lansing will defend the suit. At the same time the protest likewise charges fraud against Calumet and Osceola Townships and against the board of supervisors as a whole for not changing the valuations at the county equalization meeting, so that the suits may include the two townships and the whole county board. Further developments will be watched with a great deal of interest.

The Michigan Copper Production during 1915 broke all records in the history of the district, reaching a total of 259,352,000 lb. The nearest approach to this figure was in 1909, when production totalled 231,870,000 lb., and in 1905, when production reached 230,437,000 lb. The Osceola produced 20,045,000 lb.; Ahmeek, 21,500,000; Wolverine, 7,400,000; Mohawk, 15,800,000; Isle Royale, 9,500,000; Calumet & Hecla, 72,000,000; Centennial, 2,500,000; Allouez, 10,000,000; Mass Consolidated, 6,000,000; Superior, 4,000,000; Franklin, 2,600,000; Copper Range Consolidated, 54,000,000; Victoria, 2,500,000; Quincy, 20,000,000; Winona, 1,500,000; Hancock Consolidated, 1,400,000; Tamarack, 3,400,000; White Pine, 3,000,000; La Salle, 700,000; Houghton Copper, 270,000; South Lake, 82,000; Lake Copper, 855,000; total, 259,352,000 lb. These figures are actual output for year just closed; the per annum rate of output, based upon actual output for the month of December, 1915, is, on the average, 25% higher than the average for the past year. The first quarter of the year 1915 showed an output much below normal. The European War made the strongest copper market ever seen for Michigan copper, which is particularly valuable for war munitions, and was and is today in demand for that purpose at figures a little higher than the copper produced anywhere else in the world.

JOPLIN, MO.—JAN. 15

In the Webb City Field there has been a number of new mills started and within the coming 30 days will enter the production column. The Ben Franklin, National, Queen Esther, the old McGregor and several others are rapidly nearing the point where production will be possible. If good weather comes within 10 days the plants will be ready in February. The continued increase of production from this part of the district is not only surprising but present plans make certain a still greater production before another six-month period. It will not surprise many if this part of the district produces as much ore as all the rest of the district put together before the end of the coming summer.

Sweeping Over the District this last week came in quick succession one of the heaviest rainfalls, a complete coating of ice, a heavy sleet, a little snow and a temperature below zero which completely paralyzed practically all operations connected with the mining industry. The rains flooded the shallow mines and those properties lying along the streams which were far out of their banks. The coating of ice and sleet tied up the rail traffic and prevented men from getting to their work on the interurban car lines. The roads throughout the district were in bad condition. Telephone and telegraph lines were broken down. The low temperature froze up the mills and shut off pipe lines and stopped practically all exposed surface work. On top of all these disasters there was a shortage of natural gas and there is the biggest shortage of coal ever known in the field.

This Outline of Conditions will indicate how mining is faring throughout the Joplin mining field and forecasts a period of inactivity until rehabilitation can be brought about. It will take several weeks to get the ground pumped out at many points, and that production can be resumed on a normal basis under 30 days, even barring further bad weather, now appears impossible. The interference with the prospecting and new development work under way all over the field is severely felt, because never in the history of the district has there been more new development work under way. Mill construction has necessarily been stopped and the impossibility of delivery of building materials off the main roads has held up and will continue to hold up this work for some time to come. This has been especially noticeable in the new camps in Oklahoma, where the roads are nearly impassable. It took a team of 10 mules to get a boiler from the station to the camp and nearly a week was consumed in the work. This is but a sample of the conditions that prevail there and in all the district where the work is being conducted off the rock roads.

TORONTO—Jan. 15

The Issue of 5c. Cobalt Coins, recently suggested by Thomas W. Gibson, Deputy Minister of Mines for Ontario, in place of the present small silver coinage, appears likely to lead to practical results. Cobalt mining men have taken up the matter and are urging the government to adopt the proposal, which is now under consideration by the Finance Department. In addition to stimulating the mining industry it would be a desirable change as the present silver 5c. piece is inconveniently small.

The Mining News

ALASKA

LACKINAW COPPER (Long Lake, Copper River Valley)—J. E. McFarland, preparing to ship.

MIAMI COPPER (Seward)—A. H. Case has finished inspecting Herschell-Parker claims out of Seward and has returned to New York to report on his work.

DELAP DEVELOPMENT (Unga)—Cyanide mill for retreatment of 400,000 tons of tailings from old Apollo mill has been completed. Tailings average $3 per ton. F. R. Brown is president of company.

ALASKA COPPER MINES (Fidalgo Bay, Valdez)—The Admiral Evans took cargo of 500 tons of copper ore for Tacoma smeltery from above property on her last trip south in 1915. Wharves and bunkers for deep sea vessels have been built and this company expects to be producer from now on. E. D. Reiter is general manager.

KENNECOTT COPPER—Both Kennecott and Beatson divisions are showing great activity. At Jumbo mine of Kennecott division new air compressor will be installed and at Beatson increased mill capacity, including flotation, is being installed. It is reported that new large body of ore has been encountered at Beatson mine on Latouche Island.

ALASKA GOLD BELT (Juneau)—Late in December snowslide carried away blacksmith shop at mouth of the adit tunnel and because of threatened reoccurrence of slides and danger to tunnel crews, tunneling was stopped until spring. Lynch Bros. has started to diamond drill from the face of tunnel, having signed contract with A. B. Dodd, managing director.

ARIZONA

Gila County

IRON CAP COPPER (Miami)—Will install new boiler and new double drum hoist.

Graham County

SAN JUAN (Safford)—J. C. Adams and Thos. Sparks, of Phœnix, have acquired San Juan and begun work. Machinery being overhauled and shaft and underground workings being unwatered.

Greenlee County

DETROIT COPPER (Morenci)—Has finished assessment work and workmen have all returned to Duncan tent colony. Company has sent all horses, mules and burros to pasture at Safford.

Maricopa County

STURDY MINES (Phœnix)—A 36-ton mill has recently been installed at Company's mine in Winifred district, 18 mi. north of Phœnix.

COPPER CROWN (Mesa)—George H. Holgate, of Philadelphia, has secured interest in Copper Crown from A. Villman. Development work will be pushed. Hoist will supplant whim at 300-ft. point of vertical shaft, which is down 160 ft.

Mohave County

TELLURIUM MINES (Kingman)—Making steady progress with its development on claims, situated 15 mi. east of Kingman.

BIG JIM (Oatman)—Before drifting on vein, recently struck, management intends to continue shaft to 600-ft. point, crosscutting on 500- and 600-ft. levels.

IVANHOE (Oatman)—Bottom of 25-ft. Nancy Lee shaft contains free gold in 18-in. stringer. Section of main shaft between 200- and 600-ft. points has progressed 150 ft.

CARTER (Oatman)—On 250-ft. level, 20-ft., north crosscut has penetrated 7 ft. into main ledge, finding ore averaging $8.60 per ton. Continues sinking toward 500-ft. point.

MERRY WIDOW (Oatman)—Has installed 40-ft. head frame over shaft, which is 80 ft. toward 300-ft. objective point. A 25-hp. gasoline hoist and 120-cu.ft. air compressor installed.

ARIZONA TOM REED (Oatman)—Driving east on 400-ft. level from shaft of Pioneer Mining to intersect vein on own property. Drift in 300 ft.; expect to find orebody in next 50 ft. Vein on top has length of 300 ft., average width 4 ft.

KINGMAN ZINC (Kingman)—Recently purchased De La Fontaine and Shooting Star mines, 11 mi. north of Kingman; is making regular shipments of zinc concentrates to smelter at Bartlesville, Okla., from 100-ton mill, kept in constant operation. Working force at mines to be largely increased.

TUNGSTEN MINES (Boulder Cañon)—Is making frequent shipments of tungsten concentrates, averaging about 60% and valued at about $2 per lb. In addition to its 12 lode claims the company owns 60 acres of placer ground upon which development operations are to be started soon.

Yavapai County

JOHN GARDNER (Prescott)—Colorado mining men have bought this property in Tip Top section.

PRINCE ALBERT (Groom Creek)—Main shaft down 125 ft. Drift on 100-ft. level in 12-ft. vein good milling gold and silver ore.

TUNGSTEN (Turkey Creek)—Fred. E. Haight cut 3-in. vein that ran 25% tungsten, and a parallel vein of good silver ore at depth of 8 ft.

WHITE PICACHO (Beardsley)—Close corporation formed by V. Messinger, of Phoenix, and C. D. Rogers, of San Francisco to operate the White Picacho mine.

LITTLE JESSIE (Chapparal)—Original owners are to resume operations; lease to Chapparal Mines Co. having expired. L. W. Smith will have charge.

RUTH (Prescott)—New 50-ton mill is in operation. Recent falls of rain and snow insure continuous operations till summer. Recovery of zinc and silver satisfactory.

GREAT SOUTHERN (McCabe)—Has installed hoist and other equipment upon its group of gold claims near McCabe. Drifts and cross-cuts are to be run from main shaft at depth of 280 ft.

CALIFORNIA

Amador County

CHEROKEE (Plymouth)—Property being opened by crosscut tunnel planned to tap vein at 100 ft. vertical depth. Federwitz and Davis, owners, have applied for mineral patent.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary statement for November shows 10,000 tons of ore milled; value, $46,949; total working expense, $24,184; total development expense, $4,640; surplus, $18,125.

Calaveras County

CALAVERAS COPPER (Copperopolis)—Crushing plant being remodeled and new mill of 250-ton capacity ordered and will be installed immediately. Coffer and Trask, who are working under lease, employ 25 men, shipping good ore.

Eldorado County

FROG POND (Garden Valley)—Sam W. Collins, owner, is installing 2-stamp mill for crushing 400 tons of ore accumulated from development work.

Inyo County

YANEY & ENLOE (Bishop)—This and 19 other claims, including the Nobles, Powning & Cooper groups, have been bonded and will be developed for tungsten by A. S. Darcy and Clyde Cameron, of Goldfield, and A. E. Julian, of Reno. Reported that George Wingfield is back of enterprise.

Kern County

SHIPSEY (Randsburg)—New 5-stamp mill nearing completion. Will be modern in every detail. Construction is under direction of Robert Lanka, superintendent.

Mariposa County

MARBLE SPRINGS GOLD (Mariposa)—Permitted to issue 60,000 shares to R. C. Haywood and J. H. Flink in part payment for Eubank mining claims, and to sell 60 shares, to net not less than 80c. per share. Haywood and Flink to receive $10,000 in money to be paid from 40% of gross receipts of stock sales. Claims were located in 1850 and worked intermittently for 40 years. Property has been abandoned since destruction of surface improvement by fire about 6 years ago.

Plumas County

KUMBAK (Taylorsville)—Company permitted by corporation commission to issue 77,500 shares in exchange for property and money advenced and to sell 23,500 shares, to net not less tran 90c. per share.

ENGELS (Keddie)—Permit issued to sell 133,395 shares at $1 per share to net not less than 95c., to be used for constructing railroad 26 mi. from mine to Keddie, on Western Pacific. Most of this stock will be taken by present stockholders. Concentrates are being shipped to Garfield, Utah, at the rate of 15 cars a month. Hauling is done by 16 teams employing total of 136 animals, to railroad at Keddie. Output of mine and plant has been increased to 350 tons.

Shasta County

CROWN DEEP (Redding)—Power line was stripped of wire about year ago by thieves and mine has been idle since. Restoration of line is in progress and shipments to Kennett will follow.

MAMMOTH (Kennett)—New main tunnel has been started. It is 7½ ft. by 8½ ft. and will be driven 5,000 ft. This will be longest tunnel in Shasta County copper region, and will cost approximately $100,000. The tunnel will cut ore lenses at depth of 400 ft. below present lowest workings and develop an immense area of new ground. Three furnaces running at smeltery. About 250 tons of zinc ore being shipped daily to Eastern smelteries. Payroll numbers 600 men.

SHASTA-BELMONT (Copper City)—Lower tunnel being advanced to intersect main orebody where an important deposit of copper ore is expected. Good ore is exposed in the old workings, being of high grade and containing beside the copper some gold, silver and zinc. Good wagon road extends from the mine to Heroult, the present nearest railroad point. Shipments will be made to the Mammoth smeltery at Kennett. William Arps is superintendent.

Sierra County

ORO (Downieville)—Contract let for extending tunnel 200 ft. at $9 per ft. Mine being developed by Dr. G. P. Reynolds, of Alameda, Calif.

BANNISTER (Downieville)—Rich ore encountered by W. O. Frost in doing assessment work. Development will be pushed the coming spring by Luke Bannister, owner.

YORK (Downieville)—Bonded to Sacramento company. Old 100 ft. shaft from which bonanza ore was extracted several years ago will be unwatered and sinking continued. All materials on ground, and work of repairing power line in progress. Geo. B. Morse in charge.

Siskiyou County

YREKA DEVELOPMENT (Yreka)—Coal-mining machinery at the mines near Ager sold at sheriff's sale to satisfy a judgment of $2,500. Property has furnished a good deal of coal for local consumers.

Trinity County

MAGNESITE CLAIMS embracing 160 acres on Tule River east of Porterville reported to have been sold by M. Y. Smith, of San Francisco, to S. R. Coghlan, until recently engaged in mining in Peru. Price said to be $100,000.

GLOBE CONSOLIDATED (Dedrick)—Samuel W. Cohen has completed examination for his company, Crown Reserve at Cobalt.

LA GRANGE (Weaverville)—Four giants are in action. Late storms provided an abundance of water. Large amount of new ground prepared during summer and fall and numerous repairs made to flumes and ditches.

UNION HILL AND HUPP (Weaverville)—These and other hydraulic mines owned by Trinity Consolidated Mining Co. are being operated under lease. Mines near Weaverville are worked by Otto B. Haas and those at Douglas City by C. H. Tarpley.

PAULSEN RANCH (Lewiston)—A giant has been put in operation. Water is brought 8 mi. by canal from Rush Creek, which delivers 600 miners' in., with 200-ft. head. There are 40 acres of hydraulic ground in this portion of ranch. Enterprise is being operated by Bablou Mining Co., under management of Fred Paulsen and C. A. March.

TRINITY ASBESTOS (Castella)—H. T. Mecum, manager of this company, has returned to Oakland for winter. Heavy snow has closed in company road and development of property has been suspended until spring. The 12-mi. of wagon road built on 6% grade has been completed at a cost of about $45,000. There is about 12 mi. more of road to be built, which will cost something less than first 12 mi. Company has also built and operates sawmill having capacity of 25,000 ft. of lumber a day, and rock-crushing mill with capacity of 100 tons a day.

Tuolumne County

REPUBLICAN (Jacksonville)—New transformer will be installed for this mine and Mammoth.

HAZEL DELL (Sonora)—Retimbering shaft preparatory to reopening mine is in progress. A 1,200-ft. crosscut tunnel is contemplated. Property is owned by L. B. Doe.

DUTCH-APP (Jamestown)—Repairs and improvements are in progress. Mill crew has been laid off until remodeling of mill is completed. It is expected to install tube mill.

RAWHIDE (Jamestown)—Unwatering mine in progress; so far cleared shaft has been found in good condition. New transformer will be installed and electric current taken from new line recently completed into this section from Copperopolis.

CALIFORNIA GOLD MINING AND DEVELOPMENT CO. (Sonora)—Permission of corporation commission to issue 34,000 shares of stock to E. Bennett and P. A. Ellis and to sell 10,000 shares at $1 par to net not less than 80c. per share. The 34,000 shares will be held in escrow pending financing of company.

IDAHO

Shoshone County

HIGHLAND-SURPRISE (Kellogg)—Six teams hauling concentrates to railroad at mouth of Pine Creek, 8 mi. Mill recently overhauled and flotation added. Ore is lead and zinc.

CASTLE ROCK (Wallace)—Located on Placer creek and being developed through shaft 200 ft. deep. Has 6 ft. copper ore that averages about 5%. Electric power will take place of water this spring.

ROANOKE (Kellogg)—Lessee John Grenfel has carload of lead-silver ore ready for shipment. Also has large amount of lower-grade ore on dump being hand jigged. On Elk creek 1½ mi. from railroad.

LITTLE PITTSBURG (Kellogg)—Mill being rushed to completion and expected to be turning out concentrates by end of January. Capacity of mill is 250 tons. Has body of zinc ore reported comparable to Interstate-Callahan in size.

SUNSET (Wallace)—New compressor and hoist installed, awaiting completion of electric line to supply power. Old plant run by gasoline. Shaft down 400 ft. with drifts east and west at 200 and 400. Sinking will begin as soon as power connection is made, about Feb. 1.

UNION (Burke)—After years of idleness property is under lease and bond to Axel Swan, of Burke. Surface work west of old workings opened up 20 ft. of carbonate ore carrying 8% lead and 15 oz. silver. Prospect shaft sunk 25 ft. Lessee negotiating with Oreano company to use tunnel which will cut vein at 500 ft. depth in about 250 ft.

PATUXENT (Wallace)—Drifts both east and west from main crosscut reported to have 5 or 6 ft. commercial lead and zinc ore; considerable shipping grade. Manager and principal owner of Patuxent is James F. Callahan, original owner of Callahan mine and now largest individual stockholder in Consolidated Interstate-Callahan.

MICHIGAN

Iron

ODGERS (Crystal Falls)—Hoist started last week. Rock drills can now be used in shaft.

SPEIS (Iron River)—Shaft work started. Boilers, hoist and compressor being installed. Ore is close to surface; shaft sinking will not require much time. Ore will be shipped this season.

HILLTOP-VICTORIA (Crystal Falls)—Work of reopening mine started. Hilltop has a fair-sized orebody; Victoria has never been thoroughly explored. Some of buildings damaged by fire year ago being repaired.

TRADERS (Iron Mountain)—Orders given this week to resume operations to superintendent: "Get started as soon as possible and run to capacity until the end of the shipping season this year." Mine owned by Republic Iron and Steel Co.

TOBIN (Crystal Falls)—All of the water has now been removed by bailers and pumps. Considerable work remains to be done underground. All new wires have to be strung. Some of machinery was taken to surface when the mine was closed. This will have to go underground again. It is believed ore will be coming to surface by Mar. 1.

MINNESOTA

Duluth

MINNESOTA STEEL CO. will be unable to start manufacture of cement Feb. 1. Delay in receiving machinery is cause. Orders were placed months ago but congestion in machinery trade would not permit filling of orders as desired. Now believed that cement plant will not get under way before March or April.

Mesabi Range

CHESTER (Chisholm)—Shaft bottomed in rock January 3rd at 260 ft.

GLEN (Chisholm)—Installation of electric haulage system completed. Change from hand to power tramming is expected to increase production 10%.

MACE NO. 2 (Nashwauk)—Cold weather has caused suspension of stripping operations. Quinn-Harrison had to suspend because of shortage of common labor.

TIOGA (Chisholm)—Shaft completed at 191 ft. and station cut. Construction of headframe held up temporarily by D. M. & N. Ry. steam shovel grading for trackage.

FOWLER (Aurora)—Company organized to work this mine. Lease was given up by Jones & Laughlin Ore Co. some months back. Considerable ore remains in workings.

HAWKINS (Nashwauk)—All stripping operations stopped. When temperature dropped to 52° below zero, men could not remain on job. No further work will be done until spring.

ST. JAMES (Aurora)—Tracks being laid to property by Iron Range R.R.; right-of-way was graded when shaft was sunk 6 yr. ago. Shaft will be retimbered as soon as it is unwatered.

WEBB (Hibbing)—Mine work will be resumed. Property closed for two years. Pumps have been running several days and workings now almost free of water. Fifty miners will be employed at start.

OLIVER IRON MINING (Hibbing)—Over 1,000 men employed by this company in Hibbing district this winter. Seven shovels are stripping. Cold snap caused some delays. Stripping is being carried on at the Hull-Rust, Sheridan and Sellers pits.

Vermilion Range

SOUDAN (Tower)—Oliver Iron Mining Co. has started Leyner-Ingersoll drill in bottom of shaft, at 1,600 ft. This type of drill is new in this district and creates considerable interest.

MISSOURI—KANSAS—OKLAHOMA

MOCKING BIRD (Joplin, Mo.)—Is to build small plant on lease situated southeast of Joplin; heretofore has handled ore by hand jigs.

HOMESTEAD (Galena, Kan.)—Succeeded in dewatering ground on Stanley lease of Blooming land situated south of Galena. Sub-letting ground to miners in lots 299 ft. square; several shafts are already let out and development work has commenced. Company will build lead and zinc concentrating plant to take care of ore mined on ground; will be 150 tons capacity and use gas for power. John McClaren is superintendent.

MONTANA

Fergus County

BARNES-KING (Kendall)—December North Moccasin yield $39,000 from 3,946 tons of ore. At Piegan-Gloster milled during December 2,650 tons of ore; cleanup estimated $15,000. Will pay a dividend of 7½c. per share on March 1. This is first dividend paid by company since its organization.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Is engaged in sinking two new shafts and will add a number of men to its mining force for purpose of opening new levels and doing development work to increase production later.

DAVIS-DALY (Butte)—C. G. Schirmer, secretary-treasurer of the company, after an inspection of property, decided to recommend to directors installation of new hoist, capable of working to depth of 3,500 ft. Mr. Schirmer denies rumor of possibility of another assessment on stock. Claims company is earning $2,000 a day over all expenses.

TUOLUMNE (Butte)—It is likely Tuolumne mine will be closed again within short time. Ore mined from old levels is too low in grade to leave any profit, although company has been "breaking even." Treasury is without means of prosecuting development work, and there is talk of possibility of one of old companies taking over mine, which could be worked at profit by either Anaconda or North Butte, whose properties adjoin Tuolumne.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Preliminary estimate for December shows 35,000 tons mined and milled, yielding gross $212,000. Operating expenses were $161,000, leaving net profit of $51,000.

JUMBO EXTENSION (Goldfield)—Preliminary estimate for December shows 2,938 dry tons, gross value $110,000 mined and shipped. Freight, treatment and sampling charges amounted to $28,000 and smelting loss $12,500. Operating expenses were $16,500, leaving net realization of $53,000.

CUPRITE COPPER CO. (Goldfield)—Property of this company together with ground of the Iron King Co. and a number of adjoining claims has been recently optioned to ex-Senator W. A. Clark, and crew of 10 men is now engaged in preliminary development. Properties are about 3 mi. from Las Vegas & Tonopah R.R. and about 16 mi. south of Goldfield.

Humboldt County

WINNEMUCCA MOUNTAIN (Winnemucca)—Foundations for new 50-ton mill completed and buildings being erected. Will use electric power. Water being pumped from Humboldt River, distance of two miles.

ROCHESTER MINES (Rochester)—At distance of 1,470 ft. in Friedman tunnel, 450-ft. raise started to connect with Codd winze. Ore will then be dropped to tunnel for transportation to mill. Several thousand tons of broken ore now stored in upper workings. Mill is treating 120 to 130 tons per day.

Lincoln County

CONSOLIDATED NEVADA-UTAH (Pioche)—Work started on company's 75-ton plant; wet concentration followed by oil flotation. Electric power will be used generated by oil engines at property. Water will be supplied from mine.

Mineral County

GOLDEN PEN (Rand)—Property under option to J. H. Miller and associates. Price stated to be $150,000. Has produced about $50,000 in last 12 months, greater part of which was from ore averaging over $1,000 per ton.

Nye County

TONOPAH ORE PRODUCTION for week ended Jan. 8 was 9,943 tons valued at $204,934 compared with 7,567 tons for week previous. Producers were: Tonopah Belmont, 3,113 tons; Tonopah Mining, 2,750; Tonopah Extension, 1,850; Jim Butler, 1,100; West End, 837; miscellaneous leases, 293 tons.

RESCUE-EULA (Tonopah)—Sinking resumed middle of January with 1,100 level as objective. Development on 950 level will continue meanwhile.

JIM BUTLER (Tonopah)—During fiscal year ended Sept. 30, 1915, property produced 48,533 tons of ore having gross value of $934,321 or $19.25 per ton from which operating profit was $345,725 or $7.11 per ton.

TONOPAH BELMONT (Tonopah)—Will exercise option held on Surf Inlet property, situated on Princess Royal Island, British Columbia. Property under development by Belmont company for last 18 months.

GREAT WESTERN CON. (Tonopah)—Announced that control of company has passed to Greenwater Copper Mines and Smelter Co. through purchase by latter of 1,100,000 shares of Great Western stock. Property is in Tonopah's "Western Section" about ½ mi. south of Tonopah Bonanza property also controlled by Greenwater company. Shaft now being unwatered and crosscutting will start from 1,150 or bottom level.

Storey County

ANDES (Virginia)—Saved 21 cars of ore on 350 level.

CROWN POINT-BELCHER (Gold Hill)—Extracted from 1,600 level 306 cars mill ore and milled 343 tons dump rock and 232 tons mine rock. Shipped one bar bullion.

COMSTOCK PUMPING ASSOCIATION (Virginia)—All pumping plants working smoothly and repair work continued. Union shaft reopened to 70-ft. point below 2,000 station.

MEXICAN (Virginia)—West crosscut on 2,500 level in porphyry and stringers of quartz of low assay; east crosscut, 2,700 level in porphyry and quartz of low assay. Mexican mill crushed 462 tons custom ore, average assay $14.17. Shipped five bars bullion.

UNION CON. (Virginia)—On 2,500 level extracted from No. 1 stope 23 tons averaging $21.62; No. 2 stope, 135 tons averaging $20.21; No. 3 stope, 104 tons averaging $9.82; on 2,400 level from No. 4 stope, 48 tons averaging $10.24.

SIERRA NEVADA (Virginia)—Winze in 2,500 level, No. 1 stope, sunk 6 ft.; bottom in ore averaging $25.00; saved 20 tons averaging $24.93; from No. 1 stope 132 tons averaging $9.96. West crosscut in vein matter of low assay. Shipped to mill 152 tons, $1,814 gross.

OPHIR & CON. VIRGINIA (Virginia)—West crosscut 2,700 ft. level in vein porphyry reached 254-ft. point. Ophir at Central tunnel on 250 ft. Level found old stope containing fill of fair value. Saved from stopes and development work 165 cars. Mill resumed operation after five days' shutdown.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—Has posted notices in four languages announcing that during 1916 it will pay bonus of 10% of their yearly wages to all employees who have worked for company year or more. Bonus will be made in four payments, January, May, August and December.

NEW MEXICO

Grant County

ROYAL JOHN (Santa Rita)—Statement at directors' meeting showed that $22,000 had been spent in last 6 months in development work, building roads, and experimental milling tests. E. Coxe was appointed to take charge of construction and A. L. Owen superintendent of mine. Machinery will soon be installed.

Socorro County

TRI-BULLION (Kelley)—The newly elected Board of Directors consists of Judson G. Wall, Chas. T. Brown, A. J. Smith, Howell H. Barnes, W. D. Johnston, Gustavos Taylor, John M. Henderson, Howard Paschal, H. Z. N. Dennis. Of these, only Howard Paschal served on the previous board.

SOUTH DAKOTA

Lawrence County

WASP NO. 2 (Flatiron)—Administrator's sale of 125,000 shares of stock, of Jack Gray estate, made to local parties at 35c. a share.

HOMESTAKE (Lead)—Annual distribution of 7% of their yearly earnings being made to employees, who were on December payroll.

Pennington County

U. S. GYPSUM (Rapid City)—Plant recently destroyed by fire has caused suspension of work at gypsum mines of company. Mill had a daily capacity of 50 tons plaster.

UTAH

Beaver County

CROFF (Milford)—Mine buildings are completed, and development will begin as soon as hoist and compressor have been installed. A trial shipment of lead-silver ore has been made.

CREOLE MINING (Milford)—This property has been leased to G. H. Dern and C. C. Griggs, and five men will start breaking ore for shipment. Lessees are to equip the property with necessary machinery, and have privilege of taking ore from any part of property. There are six patented and four unpatented claims. The ground adjoins the Croff.

Box Elder County

LAKEVIEW MINING (Ogden)—Driving its main tunnel, now in 400 ft. Production continues at rate of 750 tons a month.

WESTERN ZINC (Ogden)—Operating lease on ground owned by Lakeview Mining Co. shipped six cars of zinc ore averaging 32% during December. This company has done about 1,500 ft. of development work.

Juab County

TINTIC SHIPMENTS in December amounted to 592 cars, 24 companies shipping. Total shipments for the year were 6,458 cars—2,770 for the first half of the year, and 3,688 for the second—as compared to 5,824 cars in 1914.

LOWER MAMMOTH (Mammoth)—Sufficient ore is being shipped to meet the expense of development and leave small surplus. Ore opened on 1,000 level being followed upward through raise; on 700, drifting has been started to reach ore from above; work is in new ground.

Salt Lake County

UTAH APEX (Bingham)—Report for year ended Aug. 31, 1915, shows receipts of $848,821 and net profits of $271,497.

Summit County

PARK CITY SHIPMENTS for December amounted to 10,360 tons.

ONTARIO SILVER MINING (Park City)—This company, which owns two drain tunnels, which drain the Daly-Judge, Daly West and Thompson-Quincy mines, has brought suit against the treasurer of Summit County to prevent collection of taxes levied on income received from leasing of these tunnels, and assessed as net proceeds. Company alleges that as tunnels do not drain Ontario, revenue from them cannot be designated as net proceeds of that mine. Taxes for 1914 amount to $2,163, income from tunnels having been $21,828.

CANADA

Ontario

TOUGH OAKES (Kirkland Lake)—Will install another agitator in mill.

VIPOND (Porcupine)—Has recently intercepted vein on 500 level beyond fault.

HOLLINGER (Porcupine)—Is installing new power substation; capacity of 3,600 hp.

CREOSUS (Munroe)—Has purchased plant of Badger mine in Cobalt, which will be moved to Munroe.

R. A. P. SYNDICATE (Boston Creek)—Is installing small plant, and will start drifting on 100 level.

LA BELLE (Kirkland Lake)—New plant is installed and underground work has been started again.

SMITH LABINE (Sesekinika)—Is under option to Kerr Lake company of Cobalt. Plant is being installed.

McDONOUGH (Boston Creek)—Nissen stamp has been purchased from Dome and new owners will install small plant.

PLENAURUM (Porcupine)—Sampling by La Rose completed. Mine being kept unwatered by owners, pending some other deal.

APEX (Porcupine)—Shareholders will be asked at special meeting on Jan. 24 to authorize sale of 700,000 shares of treasury stock at not less than 15c. per share.

SUCCESS (Porcupine)—Will be opened up by new company having capital of $3,000,000. The new company has a year's working option.

DOME (Porcupine)—Production for December established new record, amounting to $160,950, from treatment of 30,120 tons of ore; average of $5.39 per ton.

HAYDEN (Porcupine)—Shaft being put down and machinery for operating to depth of 500 ft. being installed. Plans in preparation for the erection of 120-ton mill.

NIPISSING (Cobalt)—During December ore mined estimated value $112,907; bullion shipped from Nipissing and customs ore estimated value $379,642; low-grade mill treated 6,754 tons and high-grade mill treated 71 tons and shipped 681,213 oz. silver.

SOUTH AMERICA

DEPOSITS OF WOLFRAMITE are found in several places in the Province of San Luis, Argentine Republic. The principal deposits are in the Carolina and Condores districts. In the Condores locality it is found in quartz veins that are nearly vertical, and has been explored from the surface to a depth of about 600 ft. A German syndicate has been operating in this district for several years; just before the war started this company acquired additional machinery so as to open up on a larger scale, but closed the mine when the war broke out. It has a mill and separating house, and ships the concentrates to Germany. Concentration is done by jigs and tables; the fine stuff is separated by selective water jets on a revolving table. The mine entrance is by tunnel in mountain side which runs horizontally for about a half mile to the shaft, which is about 400 ft. deep, and connects the different levels. Some wolfram mines have been opened in the Carolina district, and some have installed crushing and grinding machinery, but the drilling is done by hand. Both localities are somewhat remote from railways, transport high, and firewood, the only source of fuel, becomes scarcer every year.

The Market Report

Metal Markets

NEW YORK—Jan. 19

All of the markets were strong during the last week, especially spelter, which rose sharply in price, but in none of the markets was the volume of business reported very large.

Copper, Tin, Lead and Zinc

Copper—The slight tendency toward shading of price that was reported in the latter part of last week went no further, the market on the contrary turning stronger, although the volume of business transacted was but moderate. All of the principal producers were sellers at 24c., r. t., but none of them has any copper to offer, worth speaking of, for delivery this side of April. A small amount of business was done by dealers, speculators, traders, etc., at figures both above and below the producers' price. If a buyer must have prompt copper he has to pay a premium for it. On the other hand, if a seller who has got prompt copper wants to realize, he may have to do so at a discount. Speculators are not much inclined to buy copper to carry at this level. Anybody engaging in such business wants to make a quick turn.

During the last week, Great Britain was again only a small buyer, but France continued to buy largely, producers realizing about £120, delivered there, which was equivalent to about 25½c., on which producers netted about the same as for their domestic sales, after deducting costs, insurance and freight.

Copper Sheets base price is now 30c. per lb. for hot rolled and 31c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 25½@26c. per lb., carload lots at mill.

Copper Exports for the week ended Jan. 1 are reported by the Department of Commerce at 26,586,160 lb.; the larger items being 12,511,269 lb. to France, 3,810,693 lb. to Sweden, 2,379,244 lb. to Great Britain, 2,879,261 lb. to Russia and 2,802,690 lb. to Italy. Imports were 737,903 lb. ore and matte and 1,450,758 lb. metal; 2,188,661 lb. in all.

Visible Stocks of Copper in Europe on Jan. 15 are reported as follows: Great Britain, 10,354; France, 1,327; afloat from Chile, 3,275; afloat from Australia, 4,400; total, 19,356 long tons, or 43,357,440 lb. This is a decrease of 585 tons from the Dec. 31 report.

Tin—This market was dull and showed but slight changes in price.

Visible Stocks of Tin Dec. 31 are reported as follows: United States, excluding Pacific ports, 9,496; London, 5,281; Banka and Billiton, 1,439; total, 16,216 long tons. This is a decrease of 235 tons from Nov. 30, but an increase of 2,826 tons over Dec. 31, 1914.

Lead—Right through the week independent producers reported sales at concessions from the price of the principal producer in the New York market, although they did not have to shade the price so much as in the latter part of the previous week. In the early part of the week, sales of lead at St. Louis were reported at 5.70@5.75c., although the principal producers were asking 5.82½c. The cheaper lead came apparently from dealers and speculators. Their liquidation evidently came to an end about the middle of the week, for at that time a consumer requiring a round lot found that it was unobtainable at the low prices and paid what was asked by the producers.

Spelter—This market advanced sharply on rather urgent demand by domestic consumers for early deliveries. It is thought that the freight congestion on the railways in New England has something to do with this, supplies that the manufacturers were expecting being delayed in reaching them, and the consequently being obliged to buy addtional supplies for prompt delivery. On the other hand, natural gas troubles in Kansas and Oklahoma whech are common at this season of the year caused certain smelters to hesitate about selling freely. There was not very much demand for spelter to be delivered during the second quarter, but some sales were made for that period and also there were a few sales running far ahead, such as March to August and April to December. Such contracts are entered into at relatively low prices, it being common opinion among the producers that the price is going to decline a good deal before such deliveries have to be made, wherefore, everybody wants to sell as much far-forward spelter as he can. At the close of the week, prompt spelter was quoted at about 18¼c.; February, at about 17¾c.; March, about 17¼@17¾c.; and April, 16¼@16¾c. The market closes quiet but very strong.

Sales of brass special were reported on Jan. 19 at 21½c. On Dec. 18 brass special for March delivery sold at 18½c.

A cargo of zinc ore, 5,554 tons, was received at Baltimore, Dec. 31, from Bongie, Africa.

Zinc Sheets are in demand, but the base price still remains at $23 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Business continues on a good scale.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
			23¼		5.82½	5.70	15.50
13	4.7613	56⅞	@23½	41	@5 90	@5.75	@17.00
			23¼		5.82½	5.70	16.00
14	4.7625	57	@23½	41	@5 90	@5.75	@17.50
			23¼		5 82½	5.70	16 00
15	4.7600	56⅞	@23½	40¾	@5 90	5.75	@17.50
			23¼		5 82½	5.72½	16.50
17	4.7600	56⅞	@23½	41	@5.90	@5.82½	@18.00
			23¼		5 85	5.80	16.75
18	4.7625	56⅞	@23½	40⅞	@5.90	5.82½	@18.25
			23¼		5 85	5.80	16.75
19	4.7625	56⅞	@23½	41	@5.90	@5.82½	@18.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Jan.	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
13	27	87	86¾	114	24.27	174	175½	29½	6.30	90	19.16
14	27 1/16	85¼	85	114	24.27	173	175	29½	6.30	90	19.16
15	27	.....	.....	.....	.....	.....	....	.....	.....	....	....
17	26⅞	85¾	85⅛	114	24.27	173¾	174¼	29½	6.32	88	18.73
18	26⅞	85¾	85½	115	24.49	173½	174½	29⅞	6.36	88	18.73
19	26⅞	85¼	85⅜	115	24.49	175	175½	30¼	6.53	88	18.73

The above table gives the closing quotations on London Metal Exchange, All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Jan. 19

Aluminum—The market is rather quiet still, with only moderate business. Quotations remain 54@56c. per lb. for No. 1 ingots, New York.

Antimony—The market has been firm, with a moderate but steady demand. Stocks are light. Chinese and other ordinary brands are quoted at 42@43½c. per lb., New York. Cookson's is held at 56c., with little to be had. Not much has been done in futures. Antimonial lead is in better supply, which has eased demand for antimony a little.

Nickel—The market is steady, with about the usual business. Prices are 45@50c. per lb. for ordinary forms, with 5c. premium for electrolytic.

Reports that Canada would take steps to force the refining of nickel matte in that country do not seem to present anything especially new. Nothing will be done until the Nickel Commission reports.

Quicksilver—Supplies are exceedingly scarce and consumers find it hard work to get what they need. The prices have gone up in a wild sort of way, but seem to be largely nominal Transactions are small, limited to absolute needs. New York price for large lots is $225 per flask of 75 lb., but there are no large lots to be had. For smaller orders $225@$250 per flask has been paid. San Francisco reports by telegraph $175@200 per flask, with the market firm and the metal scarce. London price is unchanged at £16 15s. per flask from both first and second hands.

Gold, Silver and Platinum

NEW YORK—Jan. 19

Gold in the United States on Jan. 1, 1916, is estimated by the Treasury Department as follows: Held in the Treasury against gold certificates outstanding, $1,475,089,229; in Treasury current balances, $216,382,509; in banks and circulation, $620,972,751; total, $2,312,444,489. This is an increase of $51,756,942 during December.

Platinum—While the situation has not changed and stocks are low, there has been very little business done. Most dealers decline to quote except to regular customers. Prices are rather lower, though still nominal. Quotations seem to range at $82.50@90 per oz. for refined platinum.

Silver—The market continues steady, with supplies moderate. No change in production is yet in evidence. Mexican shipments are very limited. Chief buying seems to be for mintage account.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Jan 15

The base price paid this week for 60% zinc ore was $106@107 per ton. The base price paid for 80% lead ore was $75 per ton.

SHIPMENTS, WEEK ENDED JAN. 15

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,690,000	87,000	764,000
Year	8,910,000	165,700	1,696,200

Shipped during week to separators, $3,632,000 lb. zinc ore.

JOPLIN, MO.—Jan. 15

Blende, high price, $112; base per ton 60% zinc, premium ore $110; medium grades $110@100, and lower grades down to $90; Calamine, per ton, 40% zinc, $80@75; average selling price, all grades of zinc, $100.10 per ton. Lead, high price $77; base per ton 80% metal contents $70@76; average all grades of lead, 73.85 per ton.

SHIPMENTS WEEK ENDED JAN. 15

	Blende	Calamine	Lead	Values
Totals this week	9,426,940	542,930	1,619,930	$563 110
this year	23,766,080	2,629,170	4,137,870	$1,472,100

Blende value, the week, $483,530; two weeks, $1,230,570.
Calamine value, the week, $19,760; two weeks, $88,270.
Lead value, the week, $59,820; two weeks, $153,260.

Iron Trade Review

NEW YORK—Jan. 19

Export orders have fallen off to some degree, largely because mills are not in a position to make the deliveries called for. Domestic business keeps coming in, notwithstanding the prices called. Car and ship orders are taking a heavy tonnage of plates, and implement makers are pressing for bars.

As long as these conditions last there seems to be no prospect of a weakening in prices. Present quotations are apparently scheduled to hold for the first half.

PITTSBURGH—Jan. 18

The railroad situation has grown worse instead of better. The Boston & Albany has added its embargo, and New England is practically shut off from steel supplies, there being scarcely any water transportation available. In extreme cases steel has been shipped by express, and through Canada via Detroit. Scarcely any export steel is being accepted from mills. For several weeks now the steel mills have shipped more steel to customers who could be reached than they would if transportation conditions were normal, yet no surpluses have developed. The steel mills are now selling much less steel than formerly, but are busy with customers who urge quicker deliveries. Specifications are very heavy on contracts, and bookings are almost constantly in excess of shipments. In nearly all instances mills refuse to sell on open contract for third quarter or second half.

Pig Iron—The market has been noticeably quiet since the first of the year. Consumers all state they are fully covered. There are still speculative stocks piled to the extent of 30,000 tons or more. We quote: Bessemer, $21; basic, malleable and forge, $18@18.50; foundry, $18.50@19, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The trade seems suddenly to have awakened to the fact ferromanganese is scarce. All the English producers have now advanced their contract price to $125, Baltimore, while domestic producers quote this price or higher, and only on late deliveries. Prompt lots have been taken eagerly at $150.

Steel—The market for soft steel continues practically nominal. The ordinary consumer is either covered by an old contract or could not afford to pay prices that would be asked, about $32@33 for bessemer and $35 for openhearth, either billets or sheet bars. Forging billets made to war steel specifications are bringing above $50.

FERROALLOYS

Ferrosilicon is in demand and firm. For high-grade, 50% up, the quotation is $83@85 per ton at furnace in the Pittsburgh District. Bessemer ferrosilicon is also firm, prices varying from $28 at furnace for 10% up to $38 for 16% alloy.—**Ferrotungsten** remains high with few sales reported.

IRON ORE

Imports and exports of iron ore in the United States 10 months ended Oct. 31, in long tons:

	1914	1915	Changes	
Imports	1,209,313	1,109,416	D.	99,897
Exports	548,827	594,639	I.	45,812

The chief imports in 1915 were 684,858 tons from Cuba, 185,198 tons from Sweden and 71,849 tons from Canada. The exports were chiefly to Canada.

OTHER ORES

Manganese Ore—Imports in November were 50,629 tons, making a total of 251,508 tons in the 11 months ended Nov. 30. This is a decrease of 5,363 tons from 1914. Nearly all the imports in 1915 were in the six months June-November, and the larger part was from Brazil.

Manganese ore exports from India in September were 66,000 tons, of which 62,100 tons went to Great Britain and 3,900 tons to Italy. In September, 1914, the exports were only 12,830 tons.

COKE

Coke production of the Connellsville region for the week is reported by the "Courier" at 429,968 short tons; shipments, 431,644 tons. Shipments from Greensburg and Upper Connellsville district were 37,712 tons.

Chemicals

NEW YORK—Jan. 19

The general market continues fairly active, and business may be called good for the season.

Arsenic—The market is inclined to be quiet, but is steady and unchanged. Prices are $4@4.50 per 100 lb. for both spot and futures, according to size of order.

Copper Sulphate—Supplies continue light and the market rather irregular. Current quotations are $20 per 100 lb. for carload lots and $20.25 per 100 lb. for smaller orders.

Nitrate of Soda—Prices are slightly firmer and the current quotation is $3.30 per 100 lb. for both spot and futures. Sales are fair.

Pyrites—Arrivals at Baltimore for the past week included 23,889 tons pyrites from Huelva, Spain.

PETROLEUM

Exports of mineral oils from the United States in November were 186,817,899 gal. For the 11 months ended Nov. 30 the total exports were 2,057,399,767 gal. in 1914, and 2,125,048,609 gal. in 1915; an increase of 67,648,842 gal., or 3.3% last year.

Assessments

Company	Delinqe	Sale	Amt.
Albany Lead, Ida	Jan. 20	Feb. 19	$0.005
Alpha, Nev	Jan. 5	Jan. 26	0.03
Alta-Germania, Utah	Dec. 31	Jan. 29	0.005
Andes Silver, Nev.	Jan. 21	Feb. 11	0.02
Atlantic, Ida	Jan. 21	Feb. 21	0.005
Baltimore Cons., Utah	Jan. 11	Feb. 11	0.002
Bay State M. & M., Utah	Jan. 10	Jan. 25	0.001
Bellerophon, Utah	Jan. 8	Jan. 29	0.005
Big Elk, Ida	Jan. 25	Feb. 15	0.001
Cedar Creek, Ida	Dec. 30	Jan. 29	0.01
Challenge Cons., Nev	Jan. 11	Feb. 1	0.05
Demijohn Cons., Nev	Jan. 7	Jan. 27	0.005
Empire M. & D. Ida	Jan. 15	Feb. 15	0.005
Gold Mt. Champion, Utah	Jan. 21	Feb. 8	0.0025
Hale Norcross, Nev	Jan. 25	Feb. 15	0.03
Idaho-Nevada, Ida	Jan. 7	Feb. 1	0.002
Imlay, Nev	Jan. 7	Feb. 8	0.01
Independence, Utah	Jan. 20	Feb. 14	0.001
Laclede, Ida	Feb. 4	Feb. 28	0.003
Lehi-Tintic, Utah	Jan. 15	Feb. 5	0.002
Lucky Calumet Cop., Ida	Dec. 27	Jan. 28	0.005
Lucky Swede, Ida	Jan. 11	Feb. 11	0.002
Massasoit, Utah	Jan. 13	Feb. 23	0.015
M. & P. Gold, Utah	Feb. 7	Feb. 21	0.0025
McKinley Gold, Ida	Jan. 28	Feb. 24	0.0005
Mexican Nev	Jan. 25	Feb. 16	0.10
Monte Cristo, Utah	Jan. 5	Jan. 27	0.00½
Nabob, Ida	Jan. 17	Feb. 14	0.005
Nevada-Anaconda, Utah	Dec. 29	Jan. 29	0.002
Nevada-Douglas, Nev	Feb. 10	Mar. 10	0.10
Old Veteran, Ida	Jan. 6	Jan. 29	0.002
Ophir, Nev	Jan. 19	Feb. 10	0.05
Rexall, Utah	Feb. 2	Feb. 21	0.01
Rob Roy, Ida	Feb. 5	Mar. 5	0.002
Sierra Nevada, Nev	Jan. 19	Feb. 9	0.10
Slavonian, Ida	Feb. 1	Feb. 29	0.001
Superior & Boston, Mich	Feb. 7		1.00
Tar Baby, Utah	Dec. 31	Feb. 28	0.005
Tarbox, Ida., (post.)		Feb. 5	0.003
Tyler M. & M., Ida	Jan. 28	Feb. 28	0.001
Utah-Oregon, Utah	Jan. 5	Feb. 10	0.0005
Victoria, Utah	Dec. 28	Jan. 29	0.01
Wasatch Marble, Utah	Dec. 15	Feb. 2	0.06
Western M. & M., Utah	Jan. 3	Jan. 25	0.0015
Western Star, Ida	Jan. 10	Jan. 31	0.001
White Cloud, Utah	Dec. 31	Jan. 24	0.01
Wisconsin, Ida., (post.)		Jan. 20	0.003

Stock Quotations

COLO. SPRINGS Jan. 18	Bid.	SALT LAKE Jan. 18	Bid.
Acacia	.04½	Beck Tunnel	.08½
Cripple Cr'k Con.	.01	Black Jack	.08
Dante	.04½	Colorado Mining	.08
Doctor Jack Pot	.11½	Crown Point	.02½
Elkton Con	.36	Daly-Judge	8.00
El Paso	1.06	Emma Cop	.24½
Findlay	.03½	Gold Chain	.56
Gold Dollar	.02	Grand Central	.55
Gold Sovereign	.05½	Iron Blossom	1.22½
Golden Cycle	2.03	Lower Mammoth	.06
Isabella	.20½	May Day	.19
Jack Pot	.07½	Opohongo	.02
Jerry Johnson	.06½	Prince Con	.77
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.43	Silver King Coal'n	3.45
Pharmacist	.005	Silver King Con	2.25
Portland	1.83	Sioux Con	.04
Raven B. H.	.02½	Uncle Sam	.07
Vindicator	2.28	Yankee	.28

SAN FRANCISCO Jan. 18			
Alta	.09	Belmont	4.50
Andes	.10	Jim Butler	1.15
Best & Belcher	.04	Lone Star	.03
Caledonia	.34	MacNamara	.04
Challenge Con	.07	Midway	.15
Chollar	.03	Mont.-Tonopah	.29
Confidence	.20	North Star	.15
Con. Virginia	.16	Rescue Eula	.08
Gould & Curry	.02	West End Con	.75
Hale & Norcross	.02	Atlanta	.20
Jacket-Cr. Pt.	.13	Blue Bell	.02
Julia	.01	Booth	.40
Mexican	.20	C.O.D. Con	.03
Occidental	.75	Comb. Frac	.07
Ophir	.27	D'field Daisy	.03
Overman	.05	Jumbo Extension	1.27½
Savage	.04	Pitts.-Silver Peak	.06
Seg Belcher	.04	Round Mountain	.42
Sierra Nevada	.38	Sandstorm Kendall	.06
Union Con	.61	Silver Pick	.04
Utah Con	.01	Central Eureka	.08

TORONTO Jan. 18			
Bailey	.04½	Dome Exten	.35½
Chambers Ferland	.29	Dome Lake	.27½
Coniagas	4.87½	Foley O'Brien	.70
La Rose	.65	Hollinger	29.25
Peterson Lake	.35½	Imperial	.04½
Right of Way	.06	Jupiter	.22½
Seneca Superior	.72½	McIntyre	1.00
T. & Hudson Bay	25.00	Porcu. Crown	.86
Temiskaming	.70	Preston E. D.	.06½
Trethewey	.17½	Vipond	.75
Wettlaufer-Lor	.08	West Dome	.15½

LONDON Jan. 4			
Alaska Tre'dwell	£7 7s 6d	Mexico Mines	£4 0s 0d
Burma Corp	1 12 6	Nechi, pfd	0 12 6
Cam & Motor	0 14 3	Oroville	0 13 0
Camp Bird	0 7 0	Santa Gert'dis	0 9 9
El Oro	0 9 0	Tomboy	1 3 6
Esperanza	0 11 0	Tough Oakes	0 11 10½

N. Y. EXCH. Jan. 18	Clg.	BOSTON EXCH Jan. 18	Clg.
Alaska Gold M	25	Adventure	2
Alaska Juneau	9½	Ahmeek	396½
Am.Sm.&Ref.,com	105¼	Algomah	1½
Am. Sm. & Ref., pf.	113	Allouez	64
Am. Sm. Sec., pf. A	93	Ariz. Com., ctfs.	9
Am. Sm. Sec., pf. B	86½	Bonanza	.35
Am. Zinc	68½	Butte Alex. Scott	9
Anaconda	88¾	Butte-Balaklava	3½
Batopilas Min	2½	Calumet & Ariz.	69
Bethlehem Steel	480	Calumet & Hecla	555
Bethlehem Steel, pf.	140	Centennial	17½
Butte & Superior	75	Copper Range	62½
Chile Cop.	23¼	Daly West	3½
Chino	54½	East Butte	15½
Colo. Fuel & Iron	47½	Franklin	9½
Crucible Steel	67⅛	Granby	85½
Dome Mines	27½	Hancock	17½
Federal M. & S.	26	Hedley	26½
Federal M. & S., pf.	55	Helvetia	.40
Great Nor., ore., ctf.	48¼	Indiana	5
Greene Cananea	47⅞	Island Cr'k, com	47
Guggen. Exp.	23½	Island Cr'k, pfd	89½
Homestake	129	Isle Royale	28½
Inspiration Con	46¼	Keweenaw	3½
International Nickel	216½	Lake	18½
Lackawanna Steel	82½	La Salle	5
Miami Copper	37⅛	Mason Valley	3½
Nat'l Lead, com	71½	Mass	12
National Lead, pf.	113½	Mayflower	3½
Nev. Consol.	15½	Michigan	1½
Ontario Min	9½	Mohawk	91
Quicksilver	4½	New Arcadian	9½
Quicksilver, pf.	6	New Idria	22½
Ray Con	24⅛	North Butte	29½
Republic I&S, com.	51½	North Lake	2
Republic I&S, pf.	108¼	Ojibway	2½
Sloss-Sheffield	60½	Old Colony	3½
Sloss-Sheffield, pf.	99	Old Dominion	64
Tennessee Copper	61	Osceola	85
Utah Copper	78½	Quincy	88
U. S. Steel, com	85⅛	St. Mary's M. L.	62
U. S. Steel, pf.	117⅛	Santa Fe	3½
Va. Iron C. & C.	60	Shannon	9½
		Shattuck-Ariz.	33⅛
N. Y. CURB Jan. 18		So. Lake	7
Alta Con	.22	Superior	25½
Beaver Con	.43	Superior & Bost.	1½
Big Four	.04	Tamarack	53½
Buffalo Mines	.95	Trinity	11
Butte & N. Y.	2⅞	Tuolumne	.15
Butte C. & Z.	8⅛	U. S. Smelting	58¼
Can. Cop. Corpn.	1 1/16	U. S. Smelt'g, pf.	50
Cashboy	.04	Utah Apex	3½
Cerro de Pasco	36½	Utah Con	13½
Con. Ariz. Sm.	1⅞	Victoria	3
Con. Coppermines	1 1/16	Winona	4½
Con. Nev.-Utah	⅞	Wolverine	61½
Dia. Black B.	.04	Wyandot	2½
Florence	.49		
Goldfield Con	1 3/32	BOSTON CURB Jan. 18	
Goldfield Merger	.17	Bingham Mines	7½
Hecla Min	3½	Boston Ely	.48
Howe Sound	6⅞	Butte & Lon'n Dev.	.40
Kennecott Cop.	55⅛	Calaveras	3½
Kerr Lake	4½	Calumet-Corbin	.06
Magma	‡15½	Chief Con	1½
Majestic	1½	Cortez	.90
McKinley-Dar-Sa	.42	Crown Reserve	.60
Mines of Am	3½	Davis-Daly	1⅞
Mother Lode	.24½	Eagle & Blue Bell	1 1/16
Nevada Hills	.19	First Nat. Cop.	7
New Utah Bingham	5	Houghton Copper	3
Nipissing Mines	7⅛	Iron Cap Cop., pf.	7½
Oro	.05½	Mexican Metals	.42
Ray Hercules	3⅛	Nat. Zinc & Lead	2½
Rochester Mines	.69	Nevada-Douglas	.75
St. Joseph Lead	15	New Baltic	3
South Utah	.20	New Cornelia	13
Stand'd Oil of N.J.	516	Ohio Copper	.20
Standard S. L.	1 13/16	Oneco	1
Stewart	1/16	Raven Copper	.20
Success	.66	Rex Cons	.34
Tonopah	7	Smokey Dev	‡.30
Tonopah Ex.	4 7/16	Tonopah Victor	‡.35
Tonopah Merger	.60½	United Verde Ext.	6½
Tribullion	⅛	Utah Metal	9½
White Knob, pf.	‡2		
Yukon Gold	2½	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375	54.971	26.720	22.900	26.373
Year	59.791	54.811	49.684	27.576	25.314	23.675

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744	‡	93.273
December	12.801	20.133	56.841	80.773	*	100.43
Year		17.275		72.532		

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	38.779	147.102	167.000
Av. year	34.301	38.500		163.960

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3 937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800	5.355	3.662	5.266	19.097	28.790
Year	3.862	4.673	3.737	4.567		22.916

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592	15.391	5.430	15.221	27.369	89.400
Year	5.213	13.230	5.061	13.054		67.553

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.50	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	19.95	13.45	18.95	13.83	18.95
Year	$14.88	$14.89	$13.78	$13.76	$14.01	$13.89